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# BORIC ACID AS A POISON

## Report of Six Accidental Deaths in Infants

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THE common use of boric acid as a mild antiseptic has led to the general impression amongst laymen, nurses, and members of the medical profession that it is entirely harmless. Yet in the medical literature there are records of about twenty-six deaths, probably due to boric acid or sodium borate. The poisonous character of these substances is duly recorded in the standard textbooks on toxicology. It is common practice to use a solution of boric acid as an antiseptic for rubber nipples and to cleanse the nipples of nursing mothers. These solutions are rarely labelled as poisonous, but definitely should be, to prevent such tragic incidents as the one described in the present paper and that reported previously by McNally and Rust.[1]

The literature has been reviewed by Ross and Conway[2] up to 1943, recording 20 fatalities from boric acid or borax, administered as an aqueous solution, ointment or powder, for a variety of conditions. Since that paper was published, six deaths have occurred.[3, 4, 5] The present report adds six additional deaths due to boric acid which was administered orally as a 2.5% aqueous solution, in place of sterile water, in the preparation of the infants' formulæ.

### CASE REPORTS

On Sunday, September 12, 1948, a student nurse in the formula room of a general hospital prepared the following formulæ: (1) evaporated milk, I pint, to sterile water, 2 pints; (2) cow's milk, 1 pint, to sterile water, 1 pint.

These mixtures were then given to eight infants in the nursery as the 10 a.m. feeding. Other infants in the children's ward on the same formulæ, prepared by a different nurse on the same morning, did not show any abnormal symptoms. There were 17 babies in the nursery at the time. Of these, eight were on the formulæ given above, and subsequently six died. Two babies on a lactogen formula, which was prepared later from sterile water fresh from the sterilizer, were unaffected. Two additional babies, who were being nursed at the breast, were normal in every way throughout the catastrophe, although they had received supplementary feedings in the evenings of both Saturday and Sunday. The deaths occurred in the following order and at the times indicated from the 10 a.m. feeding on September 12.

| | | | |
|---|---|---|---|
| Baby P., | Sept. 13, at | 5:15 a.m., | 19 hours |
| Baby Sh., | " 13, at | 3:05 p.m., | 29 hours |
| Baby St. | " 14, at | 6:45 a.m., | 45 hours |
| Baby McM., | " 14, at | 9:15 a.m., | 47 hours |
| Baby McL., | " 15, at | 7:15 p.m., | 3 days, 9 hours |
| Baby M., | " 17, at | 11:00 p.m., | 5 days, 13 hours |

Baby P., male, aged 7 days, weight 7 lb. 7 oz. Condition at birth was described as good. Following the 10 a.m. feeding on September 12, the baby passed a green stool and vomited slightly. The following morning the child was noted to have hæmorrhagic conjunctivæ, extreme pallor of skin and to exhibit clonic convulsive movements of the arms, legs and facial muscles. Frequent, green, watery stools were passed and the child vomited a thin greenish fluid. Finally, the entire body became cyanosed and respiration was laboured until death occurred.

Baby Sh., male, aged 7 days, weight 10 lb. 4 oz., delivered by low forceps. Physical condition was good. On the day of the poisoned feeding small amounts were vomited. On the following day vomiting continued and loose greenish stools were observed. Five hours before death the infant became cyanosed and convulsive twitchings of the body were noted. Breathing became more rapid and cyanosis became generalized during the last hour of life. Body temperature was 97.4° F. throughout the period. Excoriations of the skin were observed, *post-mortem*, on the anterior portions of the neck, in the left axilla, over the left shoulder, and about the buttocks and scrotum.

Baby St., male, aged 10 days, weight 7 lb. 11 oz., delivered by low forceps at term. No abnormalities were noted. During the day of the feeding in question a small amount of fluid was regurgitated. On the following day diarrhœa and vomiting occurred as in the previous cases. Convulsive movements were also observed. The infant's body and face appeared red. Desquamation of the skin in numerous areas was noted. Respiration became rapid and shallow, which was unaffected by the administration of oxygen.

Baby McM., female, aged 6 days, weight 6 lb. 1 oz., delivered by low forceps and was normal in every respect. Here again were noted the slow onset of diarrhœa and vomiting, muscular twitchings of face and limbs, erythema and excoriations of the skin. Cyanosis and rapid respiration developed later prior to death, 47 hours after the feeding. Body temperature rose from 97.6 to 98.8° F. Some loss of weight occurred in this child.

Baby McL., male, aged 8 days, weight 9 lb. 9 oz., delivered normally. No abnormalities were noted. Some slight vomiting occurred on the day of the suspected feeding. A reddish-yellow colour of the skin, especially marked

in the area of the buttocks and scrotum, was observed on the following day. On September 14, one day prior to death, the child appeared listless and jaundiced. Excoriations in the perineal region and about the neck were present. As in the other cases diarrhœa was present and twitchings of the facial muscles were observed. On the day of death the child became cyanosed and the breathing was rapid and laboured. Rise in body temperature from 98 to 99° occurred. There was a loss of about 1 lb. in weight.

Baby M., female, aged 11 days, weight 7 lb. 4 oz., delivered in breech presentation normally. This child lived for 5½ days after the suspected feeding. Four days before death the child vomited and refused food. After gastric lavage, she took glucose and water well. Three days before death the child became jaundiced and irritable. Excoriations appeared and muscular twitchings were noticed. Vomiting and diarrhœa set in two days prior to death. Respiration became rapid and shallow with cyanosis at the end. In this child body temperature rose from normal to 99.2°, three days prior to death, to 101.2° one day before death and finally fell to 96° on the day of death.

### PATHOLOGICAL FINDINGS

Autopsies were performed on Babies Sh., St., and M.

*Baby Sh.*—The mucosa of the stomach was pinkish-red in colour and, at the fundus, a dull red. That of the small intestine showed tiny, raised, oval, whitish patches, more prominent towards the terminal end of the ileum. Both colon and small bowel contained a large amount of a yellowish-green fluid. The liver was of the usual size and shape. The tissue showed alternating whitish-brown areas, chiefly about the vessels. The adrenals were coloured a dull reddish-grey.

In microscopic examination, the capillaries of the lung were congested. Section of the small intestine showed marked thickening, with œdematous, submucosal layer containing numerous polymorphonuclear leukocytes and macrophages. The sinusoids of the liver were congested and the cells of the liver cords showed cloudy swelling and fatty degeneration with vacuolization. The adrenal medulla was extremely congested. The kidneys exhibited very marked cloudy swelling and fatty degeneration of the cells lining the convoluted tubules. The spleen was congested, toxic and showed hæmorrhages in the splenic pulp.

A section of the excoriated area of the skin showed that the keratin layer of the epidermis was splitting away from the underlying cells. The cytoplasm was entirely absent in many cells.

*The pathological description indicated an acute gastro-enteritis, dermatitis, nephrosis and hepatitis of toxic origin.*

*Baby St.*—The mucosa of stomach and intestine showed mild inflammation. The liver was somewhat enlarged, very yellow with marked fatty degeneration. The kidneys revealed some cloudy swelling, fatty degeneration and congestion but no glomerular changes, (toxic nephrosis). The microscopic examination of tissue sections exhibited congestion and mild inflammatory reaction in stomach and intestines. While the liver cells showed marked fatty degeneration, there was no necrosis. The brain was the seat of œdema and congestion only. The skin exhibited superficial, simple dermatitis with desquamation in the same situations as in Baby Sh., and also on the anterior abdominal wall.

*The pathological diagnosis was acute gastro-entero-colitis, marked toxæmia with fatty degeneration of liver and kidney (toxic nephrosis), and cerebral œdema and congestion.*

*Baby M.*—Nothing unusual was noted in the mucosa of the alimentary tract or in the gross appearance of liver or kidneys. There appeared to be some congestion in the brain. Microscopic examination of the tissue sections showed (1) marked congestion of pulmonary capillaries and presence of inflammatory cells in bronchi, (2) unusually large numbers of inflammatory cells in Peyer's patches, (3) marked cloudy swelling and fatty degeneration of cells lining the convoluted tubules in the kidney and in the liver cells, (4) fragmentation and exfoliation of keratin layer of epidermis.

*The pathological diagnosis indicated an acute broncho-pneumonia, toxic dermatitis and nephrosis.*

### BACTERIOLOGICAL EXAMINATION

All members of the attending personnel and of the babies in the nursery had swabs made of nose and throat, and rectal swabs were taken of all of the children in this ward. These showed a considerable number of coagulase-positive staphylococci in the nose and throat swabs of the babies, occurring however in those who showed no abnormal symptoms as well as those who did. No members of the *Salmonella* group of food poisoning organisms were isolated from the fæces. Cultures for typhoid and dysentery organisms also proved negative.

*Chemical analysis.*—A chemical examination was made of all fluids suspected in relation to the 10 a.m. feeding of Sunday, September 12 in-

sofar as possible with the amounts available. Chemical tests were also carried out on material from the autopsies of Babies Sh. and St.

A brown, unlabelled, gallon jug, containing about a quart of clear liquid, had been filled with sterile water and used to prepare the formulæ on the morning in question. All but 5 ml. of its contents were later discarded. On chemical examination the fluid was found to be slightly acidic (pH 4.0) and to contain traces of ethyl alcohol and chloride. It gave positive tests for boric acid by (*a*) turmeric paper and (*b*) the silver borate test. The flame test was rather questionable. The fluid left practically no residue on evaporation, which is consistent with the presence of boric acid due to its volatility.

A "bathing fluid" on the nursery floor which might have been used mistakenly for sterile water was analyzed and found to contain 14.6% ethyl alcohol and 1.89% sodium chloride. No methyl alcohol, boric acid or mercuric chloride was detected.

*Baby Sh.*—There were about 5 ml. of stomach contents. The presence of boric acid was established by the turmeric test. No tissues were available for analysis from this infant.

*Baby St.*—This child died 45 hours after the suspected feeding. There was practically no residue in the alimentary tract or in the urinary bladder. A quantitative analysis for boric acid was made on both liver and brain by the glycerol method.[6] The tissue was first emulsified in a Waring blender in the proportion of 100 gm. to 70 ml. of saturated magnesium nitrate. This was then ignited in a casserole and transferred in small amounts to a silica crucible for final oxidation. The voluminous white ash was moistened with water and dissolved with a minimum amount of concentrated hydrochloric acid. The pH was adjusted to 9 with sodium hydroxide and the fluid made up to a volume of 250 ml. Titration of aliquots with decinormal sulphuric acid, according to the method, completed the determination. The results, as averages of duplicate analyses, were as follows: Liver, (weight 125 gm.), 0.049%; 61 mgm. in organ. Brain, (weight 485 gm.), 0.025%; 123 mgm. in organ.

These concentrations are somewhat lower than the averages recorded by McNally and Rust[1] at 0.182% for liver and 0.210% for brain. They are comparable with the value of 0.028% found by McNally and Rukstinat[4] in the liver of Baby J., who died 4 hours after the ingestion of boric acid. One of the cases reported by Fellows, Campbell and Wadsworth showed a concentration of 0.236% in the liver and 0.146% in the brain.

A calculation based on these figures and the body weight of Baby St. places the amount of boric acid present in the whole body at between one and two grams at the time of death. This occurred 45 hours after the suspected feeding. According to the experiments of Pfeiffer, Hallman and Gersh[7] on dogs, 45 to 53% of administered boric acid is excreted in the first 24 hours. Later elimination is much slower. On this basis the amount ingested by the present group of infants must have been less than 3 grams depending upon the amount of the feeding and the degree of its retention. As the actual nature of this feeding is unknown it is impossible to determine the dose of boric acid which proved fatal in these cases. From the literature it is evident that the minimum lethal dose, even for mammals other than man, is uncertain. Our results would appear to support the suggestion of McNally and Rukstinat[4] that infants are poisoned by a smaller quantity of boric acid than is indicated from experiments with animals.

## DISCUSSION

In this series of fatalities the effect of time in relation to poisoning by boric acid is clearly shown. Vomiting and diarrhœa were usually the earliest symptoms which set in during the first or second day and tended to become more severe with time. Excoriation of the skin was a symptom which developed on the second day or later in these infants, although, presumably after larger doses, it may occur in four hours.[4] In most cases a generalized erythema was noted prior to desquamation. Excoriations seemed to occur most frequently in the perineal region, on the buttocks and about the neck. Convulsive movements, especially of facial muscles and of the extremities, were observed in all cases, within twelve hours in some babies, or after several days in others. Pallor of the skin was noted in the first child only and cyanosis was a general observation prior to death. In two cases jaundice was evident and this was notably true in those infants who lived for several days. Hyperpyrexia was observed likewise in these cases as a late symptom. Our

observations are thus in agreement with previous observations (see Ross and Conway[2]).

The pathological findings indicated a mild gastro-entero-colitis. A variable degree of toxic degeneration was observed in the liver, adrenal medulla, renal convoluted tubules, splenic lymphatic tissue and pulp, as well as cerebral œdema and congestion. The skin showed degenerative changes in the keratin layer with desquamation. In Baby St. there was marked fatty degeneration of the liver and kidney without necrosis. In Baby M., who died five days after ingestion of boric acid, the pathological picture was one of terminal acute bronchopneumonia, with toxic nephrosis and cerebral œdema and congestion.

Previous autopsies after boron poisoning are not very numerous. The most usual findings reported[2, 4] are congestion of liver and kidneys, cerebral œdema and congestion of toxic origin. In one case, the longest to live, it was bronchopneumonia with nephrosis. All showed an exfoliative dermatitis.

The chemical examination established the presence of boric acid in the fluid used as a diluent of the milk, in the stomach and, by quantitative analysis, in brain and liver. A concentration of 0.049% was found in the liver (total 61 mgm.) and of 0.025% in the brain (total 123 mgm.) of one child dying 45 hours after the suspected feeding. By calculation the amount of boric acid ingested must have been less than 3 gm.

Associated symptoms which developed progressively in this group of infants were: (1) vomiting and diarrhœa, increasing in intensity after the first day; (2) excoriations of the skin on the second and subsequent days; (3) convulsive movements, especially of the facial muscles and of the extremities; (4) cyanosis and collapse as terminal picture.

It must again be emphasized that solutions of boric acid or borax should be labelled "poison".

TABLE I.

SYMPTOMS AND PHYSICAL FINDINGS

| *Baby* | *Body weight* | *Time of action* | *Vomiting and diarrhœa* | *Pallor* | *Jaundice* | *Muscle spasm* | *Erythema* | *Excoriation of skin* | *Cyanosis* | *Body temperature* |
|---|---|---|---|---|---|---|---|---|---|---|
| | *lbs.* | | | | | | | | | *°F.* |
| P. | 7.5 | 19.0 hrs. | + | + | — | + | — | — | + | ? |
| Sh. | 10.3 | 29.0 hrs. | + | — | — | + | — | + | + | 97.4 |
| St. | 7.7 | 45.0 hrs. | + | — | — | + | + | + | + | ? |
| McM. | 6.1 | 47.0 hrs. | + | — | — | + | + | + | + | 98.8 |
| McL. | 9.6 | 3.4 dys. | + | — | + | + | + | + | + | 99.0 |
| M. | 7.3 | 5.5 dys. | + | — | + | + | + | + | + | 101.2 |

inflammation of gastro-intestinal tract, and occasionally œdema of the brain. The details of the pathological findings in the infants of this report agree very closely with those of the two cases of McNally and Rukstinat.[4]

The actual cause of death is interpreted as boron intoxication with associated depression of the respiratory centre and collapse (shock) with cerebral œdema and congestion. Other factors such as hepatic and renal degeneration, may play a significant rôle.

## SUMMARY

The deaths of six babies, 6 to 11 days of age, are reported as the result of one feeding of milk which had been diluted with a solution of boric acid (2.5%) in error for sterile water. The deaths occurred in from 19 hours to 5½ days.

The clinical diagnosis of death was intoxication with respiratory failure. Three autopsies were done and the pathological diagnosis was gastro-entero-colitis, hepatitis, nephrosis, and

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Like any other profession, medicine is a special division of social labour, arising first out of the unspecialized concerns and activities of human beings generally, and gradually acquiring its own characteristic forms of organization and modes of thought and action, its own life and independent momentum.—David Hawkins.

# A NEW DIETARY STANDARD FOR CANADA, 1949

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AFTER two years of study by the Canadian Council on Nutrition, a new dietary standard for Canada was approved in December, 1948. The Canadian Council on Nutrition was appointed in 1937 and serves in an advisory capacity to the Minister of National Health and Welfare of the Dominion Government.

This new standard replaces previous ones adopted in 1939, 1942 and 1945 by the Council. It will be published in English and French with suitable charts, tables and references as Volume 2, Number 1 (1949) of the *Canadian Bulletin on Nutrition*. This bulletin may be obtained from the King's Printer, Ottawa, for the sum of $1.00 per copy. The full statement of the standard should be consulted for a proper understanding of the new basis used in its development. However, the following notes and tables have been abstracted from the original to serve as an introduction for those who may use such standards in their work.

## USE

The standard is intended to be used (1) as a scientific basis for planning food supplies for individuals or groups, except where clinical observations and tests have established particular or special food requirements; (2) to assess the amount of each nutrient provided by a diet in terms of probable physiological requirements; and (3) to indicate a "nutritional floor" beneath which the maintenance of health in people cannot be assumed.

## BASIS

The standard is based on amounts actually ingested, that is on edible portions corrected for losses during cooking and serving. The ingestion of *more* of a nutrient than serves a clear physiological purpose is undesirable in the face of a world scarcity of food, and may even be harmful to the individual under certain circumstances. "More" is not necessarily "better" in nutrition and excess ingestion of nutrients should not be confused with an adequately nourished state as is sometimes referred to as "optimal nutrition".

For the first time in human dietary standards, the concept of "body size" has been fully developed. This helps to avoid the use of figures representing the highest requirement that any individual might have, since the chief cause of the common observation that one individual's dietary needs are different from another's is the variation in metabolic body size. Further, no extra allowance is made for "margins of safety" or similar adjustments which are based more on opinions than on physiological observations.

Both of these procedures tend to result in some figures that appear to be lower than some previously employed, but the differences are primarily in the basic calculations rather than arising from alternative data. The same lack of clearly established data pervades all tables expressing dietary needs, and alterations will have to be made in such figures from time to time.

In the following tables the new standard is expressed for adults and juveniles according to the degree of activity and to body weight.

## SELECTION OF FOODS TO MEET THE DIETARY STANDARD

No single food is complete in itself for all human needs. Canada's Food Rules have served as a guide to the selection of foods which would provide the necessary essential nutrients from day to day. Experience has now indicated that a few changes may be made in the rules adopted in 1944. A selection of foods from the five major groups remains the basis to meet the dietary standard as shown in the calculations applying the rules.

## CANADA'S FOOD RULES

These foods are good to eat.
Eat them every day for health.
Have at least three meals each day.

1. *Milk*—Children (up to about 12 years): *at least* 1 pint. Adolescents: *at least* 1½ pints. Adults: *at least* ½ pint.
2. *Fruit*—One serving of citrus fruit or tomatoes or their juices; and One serving of other fruit.
3. *Vegetables—At least* one serving of potatoes; and *at least* two servings of other vegetables, preferably leafy, green or yellow and frequently raw.
4. *Cereals and bread*—One serving of whole grain cereal, and at least four slices of bread (with butter or fortified margarine).
5. *Meat and fish*—One serving of meat, fish, poultry, or meat alternates such as dried beans, eggs or cheese. Use liver frequently.
   In addition—Eggs and cheese at least three times a week each.

Vitamin D—At least 400 International Units daily for all growing persons and expectant and nursing mothers. Iodized salt is recommended.

*Milk.*—The milk figures have been clarified by introducing a category for younger children. This was requested by numerous doctors and nutritionists. The old minimum level of 1½ pints daily for older children is retained, but no maximum is given, because instances were reported of adolescents being limited in their milk intake as a result of the previous statement. For the same reason the old minimum of ½ pint daily for adults has been used without the limiting effect of a top figure of one pint. Surveys show that as many as 30% of Canadian people in each of these categories do not yet achieve the minima here expressed.

*Bread.*—The new Food Rules refer simply to four slices of bread, without comment as to kind. Four slices are mentioned because that is at or above the average bread consumption in Canada at present and thus represents a reasonable goal. *The kind of bread is still important nutritionally,* but only in the way described by the Canadian Council on Nutrition at various times in the past. The following extracts from a Council statement in 1944 echo some made in 1941, and still fit the discussion in 1949 on this point:

"There is no substitute for a good diet of ordinary foods."

"The Council believes that when staple foodstuffs for any reason are nutritionally inadequate, encouragement should be given to improving their nutritional quality by whatever means are most sound from the standpoint of nutrition and economy. Since there is evidence that proper use of natural foods is more dependable for general health than placing reliance on any assembly of chemicals, whether as ingredients of a food or of a pharmaceutical, therefore the Council re-affirms its views that higher extraction of wheat, such as used to make Canada Approved White Flour, is a proper step toward assisting the public in the selection and use of foods for adequate nutrition.

"Partly owing to the rarity and expense of some items, and partly owing to our lack of knowledge at the present time, it is not possible to add to white flour any combination of vitamins which will be the nutritional equivalent of those nutrients which have been lost in milling."

TABLE I.

CANADIAN DIETARY STANDARD FOR GIRLS AND BOYS, 1948

(The figures in the table give the maintenance allowances for body weights shown plus additional needs for activity.)

| *Body*[1] *weight (lb.) with approximate equivalent age in brackets* | *Calories* | *Protein gm.* | *Calcium*[2] *gm.* | *Iron mgm.* | *Vitamin*[3] *A (as carotene) I.U.* | *Thiamine mgm.* | *Riboflavin mgm.* | *Niacin mgm.* | *Ascorbic acid (C) mgm.* | *Vitamin D I.U.* |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | GIRLS | | | | | |
| 20 (1) | 1,050 | 35 | 1.0 | 6 | 700 | 0.30 | 0.50 | 3.0 | 30 | 400–800 |
| 30 (3) | 1,300 | 37 | 1.0 | 6 | 1,000 | 0.40 | 0.65 | 4.0 | 30 | 400 |
| 40 (5) | 1,600 | 40 | 1.0 | 6 | 1,300 | 0.50 | 0.80 | 5.0 | 30 | 400 |
| 50 (7) | 1,800 | 45 | 1.0 | 6 | 1,600 | 0.55 | 0.90 | 5.5 | 30 | 400 |
| 60 (9) | 2,100 | 50 | 1.0 | 6 | 2,000 | 0.65 | 1.10 | 6.5 | 30 | 400 |
| 70 (10) | 2,300 | 55 | 1.0 | 6 | 2,300 | 0.70 | 1.15 | 7.0 | 30 | 400 |
| 80 (11) | 2,450 | 60 | 1.0 | 6 | 2,600 | 0.75 | 1.25 | 7.5 | 30 | 400 |
| 90 (12) | 2,475 | 70 | 1.5 | 6 | 3,000 | 0.75 | 1.25 | 7.5 | 30 | 400 |
| 100 (14)[4] | 2,500 | 75 | 1.5 | 12 | 3,300 | 0.75 | 1.25 | 7.5 | 30 | 400 |
| | | | | | BOYS | | | | | |
| 20 (1) | 1,050 | 35 | 1.0 | 6 | 700 | 0.30 | 0.50 | 3.0 | 30 | 400–800 |
| 30 (3) | 1,300 | 37 | 1.0 | 6 | 1,000 | 0.40 | 0.65 | 4.0 | 30 | 400 |
| 40 (5) | 1,600 | 40 | 1.0 | 6 | 1,300 | 0.50 | 0.80 | 5.0 | 30 | 400 |
| 50 (7) | 1,850 | 45 | 1.0 | 6 | 1,600 | 0.55 | 0.90 | 5.5 | 30 | 400 |
| 60 (9) | 2,180 | 50 | 1.0 | 6 | 2,000 | 0.65 | 1.10 | 6.5 | 30 | 400 |
| 70 (10) | 2,300 | 55 | 1.0 | 6 | 2,300 | 0.70 | 1.15 | 7.0 | 30 | 400 |
| 80 (12) | 2,500 | 60 | 1.0 | 6 | 2,600 | 0.75 | 1.25 | 7.5 | 30 | 400 |
| 90 (13) | 2,650 | 65 | 1.5 | 12 | 3,000 | 0.80 | 1.30 | 8.0 | 30 | 400 |
| 100 (14) | 2,850 | 70 | 1.5 | 12 | 3,300 | 0.85 | 1.40 | 8.5 | 30 | 400 |
| 110 (15)[4] | 3,000 | 80 | 1.5 | 12 | 3,600 | 0.90 | 1.50 | 9.0 | 30 | 400 |

1. Body weight or size is probably the most important cause of variations in nutrient requirements, but it is recognized that other factors also operate and that not all of the nutrients listed have been shown to vary with body size.

2. Calcium—use these values for phosphorus also.

3. Vitamin A given in terms of carotene; one-quarter of these amounts may be used if taken as preformed vitamin A.

4. For children heavier than these weights use adult standards plus an allowance for activity.

TABLE II.

CANADIAN DIETARY STANDARD FOR ADULTS, 1948

(The figures in the table give the maintenance allowances for the body weights shown plus additional needs for activity as indicated).

| *Body*[1] *weight (lb.)* | *Degree of activity* | *Calories* | *Protein gm.* | *Calcium*[2] *gm.* | *Iron mgm.* | *Vitamin A*[3] *(as carotene) I.U.* | *Thiamine mgm.* | *Riboflavin mgm.* | *Niacin mgm.* | *Ascorbic acid (C) mgm.* |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | WOMEN | | | | | |
| 80 | Sedentary | 1,625 | 40 | 0.40 | 12 | 2,600 | 0.45 | 0.8 | 4.5 | 30 |
| | Moderate | 1,900 | 40 | 0.40 | 12 | 2,600 | 0.55 | 0.9 | 5.5 | 30 |
| | Heavy | 2,400 | 40 | 0.40 | 12 | 2,600 | 0.70 | 1.2 | 7.0 | 30 |
| 100 | Sedentary | 1,825 | 50 | 0.45 | 12 | 3,200 | 0.55 | 0.9 | 5.5 | 30 |
| | Moderate | 2,100 | 50 | 0.45 | 12 | 3,200 | 0.65 | 1.0 | 6.5 | 30 |
| | Heavy | 2,600 | 50 | 0.45 | 12 | 3,200 | 0.80 | 1.3 | 8.0 | 30 |
| 120 | Sedentary | 2,125 | 55 | 0.55 | 12 | 4,000 | 0.65 | 1.0 | 6.5 | 30 |
| | Moderate | 2,400 | 55 | 0.55 | 12 | 4,000 | 0.75 | 1.1 | 7.5 | 30 |
| | Heavy | 2,900 | 55 | 0.55 | 12 | 4,000 | 0.90 | 1.4 | 9.0 | 30 |
| 140 | Sedentary | 2,325 | 60 | 0.65 | 12 | 4,600 | 0.70 | 1.1 | 7.0 | 30 |
| | Moderate | 2,600 | 60 | 0.65 | 12 | 4,600 | 0.80 | 1.2 | 8.0 | 30 |
| | Heavy | 3,100 | 60 | 0.65 | 12 | 4,600 | 0.95 | 1.5 | 9.5 | 30 |
| 160 | Sedentary | 2,525 | 70 | 0.75 | 12 | 5,300 | 0.75 | 1.2 | 7.5 | 30 |
| | Moderate | 2,800 | 70 | 0.75 | 12 | 5,300 | 0.85 | 1.3 | 8.5 | 30 |
| | Heavy | 3,300 | 70 | 0.75 | 12 | 5,300 | 1.00 | 1.6 | 10.0 | 30 |
| In pregnancy[4] (latter half) add to the maintenance plus work | | up to 500 | 25 | 1.0 | 3 | 2,000 | 0.15 | 0.2 | 1.5 | |
| In lactation[4] add to the maintenance plus work— | | up to 1,000 | 25 | 1.0 | 3 | 2,000 | 0.30 | 0.5 | 3.0 | |
| | | | | | MEN | | | | | |
| 80 | Sedentary | 1,625 | 40 | 0.40 | 6 | 2,600 | 0.45 | 0.8 | 4.5 | 30 |
| | Moderate | 2,150 | 40 | 0.40 | 6 | 2,600 | 0.60 | 1.1 | 6.0 | 30 |
| | Heavy | 2,900 | 40 | 0.40 | 6 | 2,600 | 0.85 | 1.4 | 8.5 | 30 |
| | Very heavy | 3,900 | 40 | 0.40 | 6 | 2,600 | 1.15 | 1.9 | 11.5 | 30 |
| 100 | Sedentary | 1,825 | 50 | 0.45 | 6 | 3,200 | 0.55 | 0.9 | 5.5 | 30 |
| | Moderate | 2,350 | 50 | 0.45 | 6 | 3,200 | 0.70 | 1.2 | 7.0 | 30 |
| | Heavy | 3,100 | 50 | 0.45 | 6 | 3,200 | 0.95 | 1.5 | 9.5 | 30 |
| | Very heavy | 4,100 | 50 | 0.45 | 6 | 3,200 | 1.25 | 2.0 | 12.5 | 30 |
| 120 | Sedentary | 2,125 | 55 | 0.55 | 6 | 4,000 | 0.65 | 1.0 | 6.5 | 30 |
| | Moderate | 2,650 | 55 | 0.55 | 6 | 4,000 | 0.80 | 1.3 | 8.0 | 30 |
| | Heavy | 3,400 | 55 | 0.55 | 6 | 4,000 | 1.05 | 1.6 | 10.5 | 30 |
| | Very heavy | 4,400 | 55 | 0.55 | 6 | 4,000 | 1.35 | 2.1 | 13.5 | 30 |
| 140 | Sedentary | 2,325 | 60 | 0.65 | 6 | 4,600 | 0.70 | 1.1 | 7.0 | 30 |
| | Moderate | 2,850 | 60 | 0.65 | 6 | 4,600 | 0.85 | 1.4 | 8.5 | 30 |
| | Heavy | 3,600 | 60 | 0.65 | 6 | 4,600 | 1.10 | 1.7 | 11.0 | 30 |
| | Very heavy | 4,600 | 60 | 0.65 | 6 | 4,600 | 1.40 | 2.2 | 14.0 | 30 |
| 160 | Sedentary | 2,525 | 70 | 0.75 | 6 | 5,300 | 0.75 | 1.2 | 7.5 | 30 |
| | Moderate | 3,050 | 70 | 0.75 | 6 | 5,300 | 0.90 | 1.5 | 9.0 | 30 |
| | Heavy | 3,800 | 70 | 0.75 | 6 | 5,300 | 1.15 | 1.8 | 11.5 | 30 |
| | Very heavy | 4,800 | 70 | 0.75 | 6 | 5,300 | 1.45 | 2.3 | 14.5 | 30 |
| 180 | Sedentary | 2,725 | 75 | 0.80 | 6 | 5,900 | 0.80 | 1.3 | 8.0 | 30 |
| | Moderate | 3,250 | 75 | 0.80 | 6 | 5,900 | 0.95 | 1.6 | 9.5 | 30 |
| | Heavy | 4,000 | 75 | 0.80 | 6 | 5,900 | 1.20 | 1.9 | 12.0 | 30 |
| | Very heavy | 5,000 | 75 | 0.80 | 6 | 5,900 | 1.50 | 2.4 | 15.0 | 30 |
| 200 | Sedentary | 2,925 | 80 | 0.90 | 6 | 6,600 | 0.85 | 1.4 | 8.5 | 30 |
| | Moderate | 3,450 | 80 | 0.90 | 6 | 6,600 | 1.00 | 1.7 | 10.0 | 30 |
| | Heavy | 4,200 | 80 | 0.90 | 6 | 6,600 | 1.25 | 2.0 | 12.5 | 30 |
| | Very heavy | 5,200 | 80 | 0.90 | 6 | 6,600 | 1.55 | 2.5 | 15.5 | 30 |

1. Body weight or size is probably the most important cause of variations in nutrient requirements, but it is recognized that other factors also operate and that not all of the nutrients listed have been shown to vary with body size.

2. Calcium—use these values for phosphorus also.

3. Vitamin A given in terms of carotene; one-quarter of these amounts may be used if taken as preformed vitamin A.

4. Vitamin D at least 400 international units, is also needed.

Provided that people follow the amounts and variety suggested by Canada's Food Rules, the kind of bread eaten does not make a significant difference to total nutrient intake. When special situations make following the Food Rules difficult, or when extra insurance is desired, extra nutritional advantage is secured by the use of whole wheat or longer extraction flours, or flours with nutritional values that approximate the whole grain levels by virtue of added substances such as milk, wheat germ, dried yeast, soy beans or a variety of vitamins. Nutritionists will continue to state the undisputed fact that whole wheat is nutritionally superior to ordinary white flour or bread, but will be able to continue as in recent years to emphasize the need for all people, especially including those on public assistance or in insti-

TABLE III.

A SUGGESTED MENU PATTERN
FOLLOWING CANADA'S FOOD RULES

| | *Breakfast* | *Lunch or supper* | *Dinner* |
|---|---|---|---|
| Monday | Citrus fruit[1]<br>Cereal[2]<br>Buttered toast<br>Beverage[3] | Egg sandwiches<br>Raw vegetable<br>Ice cream<br>Beverage[3] | Meat<br>Potatoes<br>Green vegetable[4]<br>Fruit tart<br>Beverage[3] |
| Tuesday | Fruit[5]<br>Cereal[2]<br>Buttered toast<br>Beverage[3] | Cheese dish<br>Buttered toast<br>Raw vegetable<br>Citrus fruit[1]<br>Beverage[3] | Meat<br>Potatoes<br>Yellow vegetable[6]<br>Milk pudding<br>Beverage[3] |
| Wednesday | Citrus fruit[1]<br>Cereal[2]<br>Buttered toast<br>Beverage[3] | Milk soup<br>Fruit[5]<br>Bran muffins<br>Beverage[3] | Meat alternate[7]<br>Potatoes<br>Two vegetables<br>Dessert<br>Beverage[3] |
| Thursday | Citrus fruit[1]<br>Cereal[2]<br>Buttered toast<br>Beverage[3] | Cheese sandwiches<br>Raw vegetable<br>Fruit[5]<br>Beverage[3] | Liver<br>Potatoes<br>Yellow vegetable[6]<br>Dessert<br>Beverage[3] |
| Friday | Fruit[5]<br>Cereal[2]<br>Buttered toast<br>Beverage[3] | Eggs<br>Bread and butter<br>Tomato<br>Cake<br>Cocoa | Fish<br>Potatoes<br>Two vegetables<br>Dessert<br>Beverage[3] |
| Saturday | Citrus fruit juice[1]<br>Cereal[2]<br>Buttered toast<br>Beverage[3] | Soup<br>Meat sandwich<br>Raw vegetable<br>Beverage[3] | Meat alternate[7]<br>Potatoes<br>Green vegetable[4]<br>Fruit salad<br>Cookies<br>Beverage[3] |
| Sunday | Citrus fruit[1]<br>Bacon and egg<br>Buttered toast<br>Beverage[3] | Cottage cheese<br>Salad greens[4]<br>Whole wheat muffins<br>Fruit[5]<br>Beverage[3] | Meat<br>Potatoes<br>Vegetable<br>Milk pudding<br>Beverage[3] |

1. Orange or grapefruit. Tomatoes, tomato juice or vitaminized apple juice may be used as alternates.
2. Cooked—rolled oats, cracked wheat or similar cereal—ready-to-serve whole grain breakfast cereals.
3. Milk for children.
4. Green beans and peas (canned or fresh), spinach, cabbage, lettuce, beet greens, etc.
5. Fresh, canned or dried.
6. Yellow corn, carrots, squash, yellow beans.
7. Fish, poultry, dried beans or peas, eggs, cheese, peanut butter.

*Note:*—Bread and butter may be added as desired. There are many forms of nutritious breads containing such ingredients as milk, wheat germ, whole wheat, rye, soya bean or dried yeast. Extras such as sugar, marmalade and jam, mayonnaise and gravy will add flavour and interest to the meals.

TABLE IV.

WHAT EACH FOOD GROUP CONTRIBUTES PER DAY (AVERAGE)

Menus similar to the above pattern were set up for two week periods at different seasons of the year and calculated in terms of nutrients for adults, adolescents and children. The results were expressed as daily averages (not necessarily the analysis for any particular day).

The table below gives these daily averages for a summer menu on the basis of servings appropriate for a sedentary man weighing 160 lbs.

| *Food* | *Calories* | *Protein gm.* | *Calcium gm.* | *Iron mgm.* | *Vitamin A I.U.* | *Thiamine mgm.* | *Riboflavin mgm.* | *Niacin mgm.* | *Ascorbic acid mgm.* |
|---|---|---|---|---|---|---|---|---|---|
| Milk ½ pint | 191 | 10.3 | 0.348 | 0.3 | 475 | 0.12 | 0.50 | 0.3 | 3 |
| Citrus fruit or tomato—1 daily | 30 | 0.7 | 0.018 | 0.5 | 518 | 0.06 | 0.05 | 0.4 | 32 |
| Other fruit 1 daily | 62 | 0.7 | 0.019 | 0.6 | 282 | 0.04 | 0.05 | 0.3 | 18 |
| Potatoes once daily | 162 | 4.1 | 0.016 | 1.4 | 45 | 0.20 | 0.07 | 2.3 | 32 |
| Other vegetables twice daily | 52 | 2.5 | 0.058 | 1.2 | 4554 | 0.10 | 0.11 | 0.7 | 28 |
| W.G. cereal 1 daily | 100 | 3.3 | 0.012 | 1.2 | — | 0.12 | 0.03 | 0.8 | — |
| Bread 4 slices daily | 318 | 11.2 | 0.036 | 1.1 | — | 0.07 | 0.07 | 1.4 | — |
| Butter or margarine (on bread) | 232 | 0.2 | 0.005 | 0.1 | 1069 | — | — | — | — |
| Meat and alternates (liver once every 2 weeks) | 453 | 25.8 | 0.023 | 4.7 | 1956 | 0.43 | 0.53 | 9.6 | 3 |
| Eggs (3 weekly) average | 34 | 2.7 | 0.011 | 0.6 | 238 | 0.02 | 0.07 | — | — |
| Cheese (3 times weekly) average | 56 | 3.4 | 0.124 | 0.1 | 246 | 0.01 | 0.07 | — | — |
| Daily total | 1690 | 64.9 | 0.670 | 11.8 | 9383 | 1.17 | 1.55 | 15.8 | 116 |
| Extras provided on daily menu average | 820 | 7.3 | 0.038 | 1.5 | — | 0.17 | 0.06 | 1.3 | — |
| Total (as in menu) | 2510 | 72.2 | 0.708 | 13.3 | 9383 | 1.34 | 1.61 | 17.1 | 116 |
| Daily requirement (sedentary man, 160 lbs.) | 2525 | 70.0 | 0.75 | 6.0 | 5300 | 0.75 | 1.2 | 7.5 | 30 |

tutions, to get the variety of food represented by Canada's Food Rules.

*Sweet foods.*—Canada's Food Rules do not specifically mention sugar or sweet foods but any practical menu must satisfy the need for extra calories and the popularity of sweet foods by including them. Sweet foods, including sugar itself in any form, honey, molasses, cookies, cakes, pastries and soft drinks, have two *undesirable* effects and should be kept at a minimum. (1) Sweet foods tend to satisfy the appetite before people have eaten enough protective foods; this is especially true of all between-meal sweets, and can lead to definite malnutrition. (2) High levels of sweets are associated with severe decay of the teeth. The teeth should be cleaned well *after eating or drinking* a sugary food. In discouraging the use of sweet foods a positive approach could well include mentioning the need to get everything in Canada's Food Rules before indulgence in sweets.

WORLD HEALTH DAY.—On July 22 World Health Day was observed throughout the world for the first time. This date, marking the third anniversary of the signing of the WHO Constitution, was celebrated by more than thirty countries which highlighted the tremendous possibilities available at present for achieving better health and showed what WHO is doing to help in realizing these possibilities.

## THE CERVICAL DISC SYNDROME*

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FOR many years the part played by protruded or displaced lumbar intervertebral discs in the production of sciatica, has been known and is now quite generally accepted. It is not so well known that damaged or protruded cervical discs may give rise to a very definite similar syndrome, producing a brachial neuritis.

Stookey in 1927, reported three cases of "chondromata" in the cervical region removed at operation. After Schmorl's reports on studies on the intervertebral discs in 1929, these chondromata were accepted as disc protrusions. These studies were followed by reports in the literature of an increasing number of such cases operated upon. Later, the radiologists Oppenheimer and Turner were the first to realize that painful shoulders were often associated "with a definite narrowing of one or more intervertebral spaces" and pointed out that the commonest locations were between C. 5-6 and 6-7. They named the condition as Discogenetic Disease with Segmental Neuritis (1937). Sparling and Scoville, by 1944, gave an accurate and complete account of the condition. Keegan's work on nerve root distribution of sensory dermatomes has assisted in localizing the disease from the clinical history and examination.

Intervertebral discs allow movement between adjacent vertebral bodies and where the spine is most flexible one finds the disc widest. Hence in the lower lumbar region and mid-cervical region this is the case. It is also a rule that lack of movement means stability and excessive movement denotes instability and proneness to damage. This also is borne out clinically for it is the lower two lumbar discs and the discs between C. 4-5-6-7 in the cervical region which rupture.

In young people a ruptured disc is the result of a definite major injury, either remote or recent, but in middle-aged and older persons degenerative changes in the discs (changes found in all connective tissues in the body) allow the nucleus pulposus to prolapse in consequence of a minor injury or even without an injury. While driving your car, you strike the curb with a tire. You examine the tire and find very little evidence of damage, yet you are not surprised to see a "blow-out" occur in that tire several months later. After a heavy lift your patient feels a pain in his groin and has a tender inguinal ring; a hernia appearing later is no surprise.

This is what occurs in the case of intervertebral discs. People hurt their necks by a blow on the top of the head or by a jerk such as the sudden stopping of cars, buses, etc., and, as most often occurs, in auto accidents. In the older patient a sudden turn of the head, stooping down or coughing may initiate the final rupture; indeed the rupture may occur while the patient is asleep, waking him rudely from his slumber.

The cervical disc is supported above and below by the cartilaginous plates on the adjacent vertebral bodies. Anteriorly there is the strong anterior longitudinal ligament, while posteriorly there is the posterior longitudinal ligament, stronger in the mid-line than laterally. This difference in strength is most marked in the lumbar region. Cervical discs may protrude posteriorly in the mid-line and produce a complete paraplegia or paralysis below this level; laterally, to cause a hemiparalysis or Brown-Sequard syndrome; or as is most frequent a still more lateral protrusion may occur which impinges only upon the nerve root and compresses it against the lamina, articular facet or even pedicle of the vertebra. Each protruded disc can compress only one nerve root but more than one disc may be affected, and each nerve root has a very definite distribution. Only the lateral protrusion causing root compression, are discussed here.

*Signs and symptoms.* — These nerves carry both sensory and motor fibres which may be irritated, or depressed by a more severe pressure. Irritation means hyperæsthesia and pain, with an exaggeration of tendon reflexes. Increased pressure gives pain followed by numbness, and interference with more delicate small movements, a weakness in the limb and weak or absent tendon reflexes.

Patients usually complain of pain in the shoulder which radiates down the arm and upwards into the neck. The pain is most troublesome at night interfering with sleep and often making them get out of bed to move about.

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Holding the head in one position as does a ledger keeper or one doing fine work also increases the pain. The pain is increased by hard work, ironing or washing and also by cold. Numbness and stiffness in the arm and fingers is a common complaint and many describe swelling of the hand. This "swelling" may be entirely subjective. Complete anæsthesia of the fingers is not common but has been noted. Often the shoulder is the point upon which attention is focussed and there may be some restriction in its movements brought about by muscle spasm. This muscle spasm restricts movements and a shoulder in a middle aged person that is kept immobile will soon become more fixed from the development of adhesions. If patients complain of pain in the shoulder and have a normal range of movements, one should look for the cause of the pain elsewhere than the shoulder and the cervical region is the place to look.

Commonly patients complain of pain in the shoulder,—as they often complain of the hip in protruded lumbar discs. On questioning they will volunteer that the pain extends upwards to the side of the neck and also down the arm. When this pain radiates down along the radial border of the forearm and even into the base of the thumb, the disc is compressing the fifth nerve root and lies between the bodies of C. 4-5. The pain which extends into the thumb and index is of the sixth nerve root distribution with the lesion between C. 5-6. Similarly the seventh root supplies the middle and ring finger and axis of the forearm, and the eighth, the ulnar border of the forearm and little finger. These painful areas indicate the particular disc involved.

Compression of the fourth nerve root (C. 3-4) produces pain above the base of the neck and top of the shoulder. Often the pain has a similar distribution in both upper extremities denoting a bilateral lesion of the one disc. At times the patient states he has recovered from a similar attack of pain in the other limb some months or years previously.

Very often on examination very little can be demonstrated in the way of clinical signs. We are then largely dependent for diagnosis on the patient's story and when one is familiar with the condition the story is usually a satisfactory one. Hyperæsthesia and anæsthesia may be demonstrated but in a large percentage of cases this is difficult. Rarely does one see muscle wasting, and loss of movements in the hands or fingers has not been encountered. Muscle weakness is commonly found in the biceps or triceps or is shown by a weak grasp. The triceps or supinator reflexes may be weak or exaggerated but this is often difficult to assess. A constant sign is usually pain on pressure over the interspace of the affected disc just lateral to the cervical spines. One will find a difference in tenderness on each side. Often the pain is acute and will shoot down the arm if pressure is exerted on the top of the head with the neck flexed to the affected side. It may be relieved by pulling the head upwards. This is done with the patient sitting,

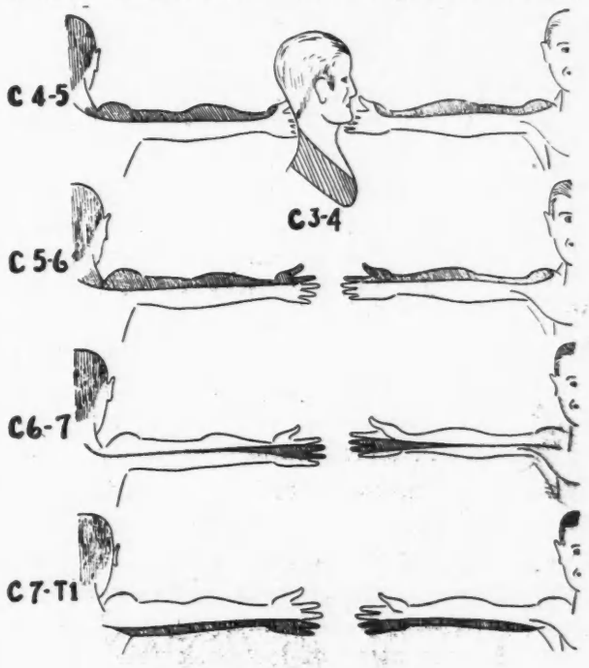


Fig. 1

by placing one hand under the chin and the other under the occiput and applying a steady constant traction.

*Radiological signs.*—A routine x-ray of the cervical spine will often show a narrowing of one or more cervical discs. It is not surprising that this narrow disc corresponds to the nerve root that is giving rise to the symptoms. This narrowing is apparent in the lateral view. It means degeneration or trauma to the disc and that this is not recent in origin.

Usually a severe injury to the neck of a young person does not immediately produce a narrow disc radiologically, but this disc narrows in the course of months or years. In young spines, as well as in older ones, where

the discs are narrowed, a loss of, or a reversal of the normal cervical lordosis is seen. This is due to muscle spasm and is similar to the flat rigid lumbar spine commonly seen in lumbar disc protrusions. A list in the cervical spine may also be seen although it is far less common than in the lumbar region.

Where the x-rays suggest cervical disc disease, a protrusion can definitely be demonstrated by doing a myelogram with a radio-opaque substance. This is not a formidable undertaking but certainly should not be looked upon as a minor diagnostic procedure, and probably should not be done unless one is prepared to operate on the patient if it is found sufficiently positive. A large defect corresponding to the site of origin of the symptoms clinically would be sufficient indication for surgical measures, yet one might hesitate to operate where the defect is a minor one. It is wiser to defer myelogram studies until conservative treatment has failed.

*Differential diagnosis.* — A classical case of protruded cervical disc is easily diagnosed by all, but until one is very familiar with the condition he will hesitate to recognize the minor or borderline cases. It is important to recognize these less severe cases as they respond remarkably well to conservative treatment and are very grateful patients.

For practical purposes 95% of sciatica is due to protruded lumbar discs and probably a similar percentage of pains down the arm are due to protruded cervical discs. Damaged or degenerated lumbar discs are the cause of the greatest percentage of low back pain and this will apply also to the neck region. Again one often sees patients with a sciatica who insist they have no back pain and yet it is a protruded disc which is giving rise to their symptoms. Patients complain of pain down their arm and often minimize the neck pain but will admit tenderness on deep pressure over the interspace of the affected disc. One commonly meets patients who have had x-rays, not of their cervical spine but of their shoulders. In dealing with these cases of neck and shoulder and arm pain one must consider the part played by cervical discs before deciding on any other diagnosis.

Our predecessors did not diagnose cervical discs but did see and diagnose brachial neuritis without knowing the cause. They commonly diagnosed subacromial bursitis and this diagnosis is still greatly overworked. Where there is a normal range of voluntary movements in the shoulder, it should not be made; and in some cases where there is some restriction of movement, it should not be made. It is not stated here that such a condition does not exist. One likes to demonstrate some calcification in the tendon of the supraspinatus radiologically to feel sure about the diagnosis and in older people with a history of trauma the question of a "capsular tear" must be considered, but the cervical spine should always be under suspicion until its innocence is proved.

Osteo-arthritis of the shoulder will give pain in the shoulder and down to the insertion of the deltoid, but there should be crepitus, and the pain does not extend into the hand. Compression of the head and lateral flexion of the neck will not aggravate this condition. A hæmoglobin estimation, Wassermann test and blood sedimentation rate should be done in all cases. The sedimentation rate is likely to be raised in rheumatoid arthritis but not in a degenerated disc. Radiologists formerly and still, report "narrow discs with marked lipping" and conclude that this is just osteo-arthritis of the spine, of little significance and not calling for treatment. It is true that many apparently normal necks will show these changes but these changes are due to a degenerative process in the disc which may have been initiated or aggravated by trauma.

Two conditions which, in their time gave concern to all were cervical ribs and the scalenus anticus syndrome. In the past few years several pairs of cervical ribs have been noted where the diagnosis was a protruded cervical disc and one of our most noteworthy patients had had a cervical rib removed previously with no relief. The scalenus anticus syndrome is a result, not a cause. Irritation of a nerve root produces a spasm in the scalenus anterior muscle which makes it stand out prominently and encourages the surgeon to resect it. It is no more the cause of the syndrome than is a spastic sacrospinalis muscle the cause of sciatica.

One of the patients who was operated on by us for a cervical disc had formerly had an anterior transposition of his ulnar nerve. Here the lesion was at the disc between the seventh cervical and the first thoracic vertebræ.

Large numbers of cervical disc cases are seen by all competent cardiologists as the patient feels that a pain down the left arm meant angina pectoris or coronary occlusion. Such a patient is living on "suspended sentence". Removal of a cervical disc will often lift the suspension, permitting him full freedom. Formerly these patients were treated for years for heart disease and many who are about today taking care of their heart have become cured of the cervical disc which originally gave them their pain. One patient was seen with a very acute brachial neuritis who, several years previously, had had a cervico-dorsal sympathectomy done for angina pectoris. Her result had always been considered a favourable one. However, cardiac patients with a true occlusion who have been confined to bed because of the heart condition may develop a stiff painful shoulder. This may occur in any patient past middle age whose shoulder is kept at rest for any length of time.

Where the disc between C. 6 and 7 is affected, the pain may radiate into the pectoralis major muscle or breast region. This may be interpreted as a cardiac pain, or in women may be confused with a mastitis. Several of these chronic mastitis cases have responded promptly to cervical disc treatment.

*Treatment.*—Conservative treatment is highly recommended and operative treatment, although generally successful must be reserved for severe and intractable cases because of the dangers and difficulties that may be encountered. Sedatives are necessary to allow the patient some rest and sleep. Morphine has not been given although one is tempted to use it in severe cases. The patient is instructed to avoid those duties or postures which aggravate the condition. They may have to stop work for a period, avoid cold, and sleep at night with one or two extra pillows to keep the neck flexed. Comfort at night may be obtained by wearing a thin pillow wrapped around the neck like a collar, to act as a splint. Looking up in the air aggravates the pain, therefore patients are told to avoid air displays and at the theatre sit in a back seat or in the balcony. The patient may be fitted with a leather collar as is used in fractures and dislocations of the cervical vertebræ. It is our experience that even if these collars are comfortable the patients refuse to wear them constantly and so they are of little practical value.

All our cases are given large doses of vitamin B complex intravenously. Three injections are given; one every second day. Usually a definite improvement is experienced after the second dose. If no improvement is obtained it is not continued for more than the three doses and if there is improvement the patient can be carried on with capsules or tablets of the complex B.

In many instances the response from these injections is dramatic. In three or four days pain has been completely relieved that has been troublesome for months; the patient feels much improved and sleeps and eats better. No explanation is advanced for the dramatic change which is more than just the feeling of well being often experienced after vitamin B therapy. Many physicians are sceptical of the results but are urged to try it for themselves. It is inexpensive and no untoward reactions have ever been noted. In a very large percentage of cases no further treatment is necessary.

Where the patient has not responded to the above, neck traction treatments are carried out. The patient may be hospitalized and a halter applied, using a constant traction with about ten pounds weight. Again this treatment is often not tolerated and with one excuse or another the halter or the weight is off most of the day. Skeletal traction with ice tongs would probably be more comfortable but has not been used by us in this condition. It is often satisfactory to have the patient take daily traction treatments at the office or physiotherapy department. These treatments last fifteen to thirty minutes and up to thirty or forty pounds weight is used. This traction is applied with the patient sitting and someone should be in attendance while it is being carried out. A course of ten treatments is recommended and additional treatments may be given at a later date if thought advisable.

We are not opposed to the patient acquiring a halter at a surgical supply house and having treatments at home. This often is very satisfactory as they can have several treatments each day. Many people are promptly and apparently permanently relieved by these treatments. A few do not respond to any conservative treatment and a time approaches when the

milder sedatives have lost their effect. It is then that the patient begs that something be done to relieve him of his misery and he is willing to accept all the dangers involved in the operative procedure.

Where the patient's general condition is not good a course of deep x-ray treatments have been tried but it has not been possible to assess the results. In this severe type of case a myelogram with a radio-opaque substance should be done and interpreted by a competent radiologist who has had experience in this field. The procedure is not an enjoyable one and in a fair percentage of cases is followed by a severe headache which may last one to two weeks, and is best treated by lying flat in bed. When a large lateral defect is seen at the suspected site an operation must be considered. It is sometimes confusing where multiple defects are present or when a large defect is seen on the opposite side.

*Operative technique.*—The patient is grouped and matched and blood made available before the operation is commenced. Usually 500 c.c. of blood is sufficient, but occasionally 1,000 c.c. is needed. A general anæsthetic is used and the operation performed with the neck flexed forward and with the patient in a semi-sitting position. It is wise to localize accurately the correct space either before or during the operation by the x-ray. An incision about six inches in length is made just lateral to the mid-line and the muscles separated from the cervical spines and laminæ and retracted laterally to reveal the desired intervertebral space including the articular facets. With a small rongeur portions of the adjacent laminæ are removed. The ligamentum flavum is removed carefully to avoid damage to the rich extra-dural venous plexus. One then sees the large nerve root running directly laterally and lying immediately posterior to the protruded disc which can often be felt with the finger. The nerve root can be retracted to a small degree upwards or downwards. There is very little room as the cervical enlargement of the cord seems to fill the spinal canal completely and strong retraction of the cord will produce a paralysis which

TABLE I.

THIRTEEN OPERATIVE CASES OF CERVICAL DISCS

| *No.* | *Sex and age* | *X-ray* | *Myelogram* | *Operation* | *Result* | *Comment* |
|---|---|---|---|---|---|---|
| 1 | F. 21 | Narrow C. 5–6 | Small axillary pouch on rt. side opp. C. 5–6 | Decompression | Excellent | Some numbness persisted for 3 mos. Returned to work 6 weeks post-op. |
| 2 | F. 39 | Narrow C. 5–6 | Large defect rt. 6th space | Disc protrusion removed | Good | Some numbness persisted for 1½ years. |
| 3 | M. 58 | Narrow C. 7–T. 1 | Antero-lateral defect C. 7–T. 1 | Protrusion removed | Very good | No postoperative trouble two years later. |
| 4 | F. 54 | Narrow C. 3–4 C. 5–6–7 | Defect lt. C. 5–6 | Decompression | Excellent | Complication—hæmatoma wound. Very excellent—early and late result. |
| 5 | F. 53 | Narrow C. 3–4 C. 5–6 | Large defect rt. C. 3–4 small defect C. 6 7 | Decompression | Very good | Follow up two years later excellent result. |
| 6 | M. 60 | Narrow C. 6–7 | Lt. axillary pouch C. 6–7 cut off | Decompression | Excellent | Immediate relief which has remained 1½ years. |
| 7 | M. 44 | Narrow C. 5–6 | Axillary pouch C. 5–6, did not fill | Disc removed | Fair | Cord damaged at operation by blunt side of curette. Some paresis remains; pain relieved. |
| 8 | F. 61 | Narrow C. 5–6–7 | Defect between C. 5–6 | Decompression | Excellent | Follow up 9 months—no arm, neck or shoulder pain. |
| 9 | M. 47 | Narrow C. 6–7 | Defect between C. 5–6 | Decompression C. 5–6 | Very good | No pain—no complications. |
| 10 | F. 56 | Narrow C. 5–6 | Defect rt. C. 5–6 | Decompression | Temporary fair | A very nervous patient. Later entered psychopathic hospital. Result of operation not assessed. |
| 11 | M. 43 | Narrow C. 5–6–7 | Protrusions C. 5–6–7 | Disc removed C. 5–6 decompress C. 6–7 | Good | Pain in neck and arm relieved. |
| 12 | M. 51 | Narrow C. 5–6 | Large defect C. 5–6 | Disc removed | Very good | Strength in arm recovered to allow him to return to heavy work. |
| 13 | F. 43 | Narrow C. 5–6 | Pouch cut off C. 5–6 rt. | Disc removed | Good | Pain not immediately relieved but progress gradual and late result good. |

may only partially recover. If a portion of the facets are removed there is more space to work in and about the nerve root.

Often it may be wise to be content with decompressing the nerve root and not to go stubbornly forward seeking the disc and risking severe complications. In our cases where the nerve root has been decompressed the symptoms have disappeared satisfactorily. Hæmorrhage is controlled before closing the wound but there is a marked tendency for a hæmatoma to form, and the wound to disrupt. A Penrose drain is left in for a few days for this reason and the muscles pulled together in layers with fine stainless steel sutures.

No special precautions are necessary postoperatively. The patient's neck is painful to move for a few days and for a considerable time there is pain in the wound from the weight of the upper extremity pulling on it. The arm pain is often absent when the patient awakens from the anæsthetic. Occasionally there is transient numbness which may gradually disappear over a period of one to three weeks.

*Clinical material.*—It is surprising how frequent these cases are. During the last few years we have seen from one to two every week. One hundred consecutive cases showing positive radiological signs were reviewed for this paper. Of these, 49 were so markedly improved by simple instructions and vitamin B injections intravenously that no further treatment was required. In addition another 15 were relieved by neck traction treatments. Twelve cases were not improved but two of these were operated upon and are now completely relieved. Twenty-two had no follow-up as they were referred from the country and did not return. There was an equal number of males and females in the series and only 16 were under 40 years of age.

Operative treatment has been carried out on 13 cases. It is believed that this represents about 3 or 4% of those seen. Operation is only performed after all forms of conservative treatment have failed. The results are very satisfactory. In one case the relief was temporary but it is now felt it was an error of judgment to operate in this case as she was very nervous and later spent a while in the psychopathic ward. In one man during the operation, the cord was lightly struck with a dull side of a curette and this was followed by a hemiparesis which has not yet completely recovered, although the man was able to return to his work shortly afterwards, free from pain. The remaining ones made prompt recoveries. There were no deaths and no other complications.

## SUMMARY

1. The problem of protruded intervertebral discs has been discussed, and the similarity between brachial neuritis and sciatica pointed. out.

2. The symptoms and signs, both clinical and radiological have been reviewed, and the examination of the patient discussed.

3. In the differential diagnosis one finds that subacromial bursitis is commonly blamed for the shoulder pain. Probably some cervical ribs and the scalenus anticus syndrome are really due to protruded cervical discs. The importance of cervical discs in cardiac cases has been noted.

4. Conservative treatment is emphasized but operative treatment as well is outlined.

5. The results of 100 consecutive cases showing radiological signs has been reviewed.

6. Thirteen operative cases are reported.

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128 Medical Arts Bldg.

## FINDINGS IN WARTIME PHYSICAL EXAMINATION OF VOLUNTEERS FOR AIR FORCE SERVICE, AND SOME IMPLICATIONS FOR THE FUTURE*

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ONLY a limited amount of useful data are available on the fitness for flying training of the male population at ages 18 to 34. Indeed, adequate data on physical fitness for any type of military service of men of military age in this country just do not exist.

During the war a great volume of information was collected regarding those conditions which occasioned rejection of individuals who applied for enlistment at R.C.A.F. recruiting centres. While the method of recording and reporting varied, the same sort of data were collected by other services in this and in other countries. One of the principal reasons for collecting data on rejections for medical reasons was to secure information as to the possible influence of progressive modification in medical standards on enlistment. It was felt that these findings might afford some insight into the prevalence of disqualifying defects among apparently healthy Canadians of military age.

In the belief that such data might afford information valuable for the future in medical and general military planning, all of the available R.C.A.F. statistics on the rejection of candidates for enlistment for medical reasons were analyzed.

*Source of data and scope of study.* — The R.C.A.F. data used in this study cover one quarter-million completed medical examinations of volunteers for Air Force service, including 99,816 aircrew candidates, 128,204 grounderew candidates and 23,278 W.D. candidates. The male examinations covered the period from August 1, 1941, to July 31, 1944; the W.D. examinations extended from September 1, 1941, to August 31, 1944—a three year period in each case.

The statistics were obtained from the monthly returns made by each recruiting centre to A.F.H.Q. These returns were modified slightly in detail at intervals during the war but the essential principles remained the same. The data were recorded daily by the examining medical officers concerned and consolidated at the end of the month. The returns included statistics on the ages of candidates whose examinations were completed during the month and a convenient statistical classification of all defects found on examination.

These R.C.A.F. data, and all data collected under similar conditions, have important limitations. Since enlistment in Canada was largely voluntary, they do not reflect the extent to which the male population of military age in the country is fit for Air Force service. Rather are they a measure of the prevalence of disqualifying defects among apparently healthy persons. The figures are much more favourable than they would be for the male population as a whole. Since there is variation from area to area in forces favouring enlistment, any observed differences in rejection rates in different areas do not necessarily reflect differences in the health of the population at the same ages. As the war progressed, medical standards were modified and significantly relaxed; the time trends in rejection rates are therefore masked to an uncertain degree.

The examination and rejection figures were compiled by age, recruiting centre, and province; the reported causes of rejection were

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tabulated and expressed in relation to persons examined. Time trends in examinations and rejections by age and region and in the disqualifying defects found, were studied.

## FINDINGS

*General rejection picture and trend.* — The analysis shows that 22.2% of all candidates for aircrew, 16.3% of all groundcrew candidates, and 16.6% of all women applicants were permanently rejected on medical grounds. These facts have important implications for the national health, but they also have most important implications for the Department of National Defence and for the nation as a whole.

The crude rate of rejection on medical grounds is contingent upon a number of factors, among which are the physical calibre of candidates in any age-group presenting themselves for enlistment, and the prevailing physical standards. As the war progressed, there were changes in both of these factors and despite the relaxing of standards the rejection rate for males increased (Table I).

TABLE I.
TREND IN REJECTION RATE
*(Rate per 100 Candidates)*

| *Year* | *Aircrew* | *Groundcrew* | *Women's Division* |
|---|---|---|---|
| Aug. to Dec. 1941 | 18.8 | 12.8 | 15.2* |
| 1942 | 22.2 | 15.8 | 19.2 |
| 1943 | 23.1 | 19.2 | 14.0 |
| Jan. to July 1944 | 25.1 | 25.3 | 9.3† |

* Sept. to Dec. † Jan. to Aug.

This trend is evidence of a definite worsening in the physical quality of the candidates examined at recruiting centres and was due largely to the depletion of manpower reserves at all ages.

The rejection rate for W.D. candidates declined substantially in 1943-44. This is due to the fact that the standards of visual acuity for women were relaxed in January, 1943.

These figures are sufficient to show that the physical quality of personnel was being diluted each succeeding year under the voluntary enlistment system.

*Rejection rate by regions.*—There were sharp differences in the rejection rates across the country (Table II).

TABLE II.
MEDICAL REJECTION RATE BY REGIONS (PER CENT)

| *Region* | *Aircrew* | *Groundcrew* | *Women's Division* |
|---|---|---|---|
| Quebec | 29.3 | 18.2 | 16.8 |
| Maritimes | 23.5 | 20.7 | 25.8 |
| Prairies | 22.2 | 16.7 | 18.2 |
| Ontario | 21.1 | 14.2 | 11.1 |
| British Columbia | 16.4 | 17.4 | 18.1 |
| Total | 22.2 | 16.3 | 16.6 |

For aircrew candidates the lowest rate was recorded in British Columbia (16.4%) and the highest in Quebec (29.3%). For groundcrew the lowest rate was in Ontario (14.2%) and the highest in the Maritimes (20.7%). The variations in the W.D. figures are quite sharp.

These rejection rates are about one-half of those reported under The National Resources Mobilization Act (Canada) and the Selective Service Law (U.S.A.) in examinations for general service. The low R.C.A.F. figures, for aircrew particularly, reflect the influence of voluntary enlistment and are in no way indicative of what one would find in examining a cross-section of young Canadian males of the same ages.

*Variations in rejection rate by age.*—These variations are illustrated in Table III.

TABLE III.
REJECTION RATES BY AGE-GROUPS*

| *Age* | *Aircrew* | *Groundcrew* | *Women's Division* |
|---|---|---|---|
| Under 20 | 21.7 | 13.7 | 15.2 |
| 20–24 | 22.2 | 13.8 | 15.0 |
| 25–29 | 24.6 | 16.5 | 17.9 |
| 30–34 | 28.6 | 19.7 | 22.3 |
| 35–39 | — | 22.4 | 34.1 |
| 40 and over | — | 29.4 | 40.2 |
| All ages | 22.7 | 16.2 | 16.9 |

*Based on original examinations completed during each reporting month.

In each group of personnel the rejection rate increases progressively with age. These increases are substantial and most striking in W.D. candidates. Actually the lowest rejection rates were at age 21 in males and at age 18 in women.

During the course of the war there was a sharp change in the age distribution of candidates for enlistment. This was particularly true of aircrew. Commencing in August, 1942, aircrew candidates under 19 years began to assume increasing prominence reaching 50% or more of the total enlisted.

*Disqualifying defects.*—In 99,816 completed examinations on aircrew candidates, 22.2% were rejected. Visual defects were responsible for 51.8% of the disqualifying defects (visual acuity, 25.4%; colour vision, 18.1%; and other eye defects including defective ocular muscle balance, 8.3%). Defective hearing and ear defects contributed 5.8%; cardiovascular defects, 9.4%; nasal and respiratory conditions, 8.4%; digestive disorders, 5.5%; nervous and mental disorders, 4.4%; and orthopædic impairments, 3.3%. In addition, 1% of otherwise fit candidates were rejected following chest x-ray. Expressed in terms of the prevalence of

TABLE IV.

DISQUALIFYING DEFECTS FOUND AMONG AIRCREW CANDIDATES*
PERCENTAGE DISTRIBUTION AND PREVALENCE PER 1,000 CANDIDATES

| *Cause of rejection* | *Number causes of rejection* | *Percentage of total causes* | *Rate per 1,000 candidates* |
|---|---|---|---|
| *Eye defects* | | | |
| Defective colour vision | 4,461 | 18.1 | 44.7 |
| Defective visual acuity | 6,244 | 25.4 | 62.6 |
| Other eye conditions | 2,037 | 8.3 | 20.4 |
| *Ear defects* | | | |
| Defective hearing | 394 | 1.6 | 3.9 |
| Otitis media and mastoiditis | 694 | 2.8 | 6.9 |
| Other ear conditions | 348 | 1.4 | 3.5 |
| *Diseases of the circulatory system* | | | |
| Abnormalities of blood pressure | 548 | 2.2 | 5.5 |
| Organic heart disease | 773 | 3.1 | 7.7 |
| Cardio-vascular inefficiency | 565 (1) | 2.3 | 5.7 |
| Varicose veins and varicocœle | 308 | 1.3 | 3.1 |
| Other diseases of the circulatory system | 126 | 0.5 | 1.3 |
| *Diseases of the respiratory system* | | | |
| Deviated septum, nasal obstruction | 541 | 2.2 | 5.4 |
| Sinusitis | 368 | 1.5 | 3.7 |
| Other nasal conditions | 328 (1) | 1.3 | 3.3 |
| Asthma and hay fever | 240 | 1.0 | 2.4 |
| Bronchitis | 186 | 0.8 | 1.9 |
| Other respiratory conditions (not tbc.) | 382 | 1.6 | 3.8 |
| *Diseases of the digestive system* | | | |
| Dental defects and conditions | 55 | 0.2 | 0.5 |
| Hernia | 716 | 2.9 | 7.2 |
| Peptic ulcer | 306 | 1.3 | 3.1 |
| Other diseases of the digestive system | 282 | 1.1 | 2.8 |
| *Nervous and mental disorders* | | | |
| Mental disorders (excluding epilepsy) | 288 | 1.2 | 2.9 |
| Other diseases of the nervous system | 796 | 3.2 | 8.0 |
| *Orthopædic impairments* | | | |
| Flat feet | 231 | 0.9 | 2.3 |
| Other foot defects | 101 | 0.4 | 1.0 |
| Lost members | 53 | 0.2 | 0.5 |
| Other orthopædic impairments | 438 | 1.8 | 4.4 |
| *Genito-urinary conditions* | | | |
| Renal conditions | 159 | 0.6 | 1.6 |
| Undescended testicle | 134 | 0.5 | 1.3 |
| Other genito-urinary conditions | 332 | 1.4 | 3.3 |
| *Others* | | | |
| Underweight | 380 | 1.6 | 3.8 |
| Diseases of the skin | 201 | 0.8 | 2.0 |
| Tuberculosis | 136 (2) | 0.6 | 1.4 |
| Arthritis and rheumatism | 108 | 0.4 | 1.1 |
| Overweight | 91 (3) | 0.4 | 0.9 |
| Diabetes mellitus | 61 | 0.3 | 0.6 |
| Venereal disease | 36 | 0.2 | 0.4 |
| Other disqualifying defects n.s.e | 1,138 | 4.6 | 11.4 |
| Total | 24,585 | 100.0 | 246.3 |

*Based on 99,816 aircrew candidates examined during the period August 1, 1941 to July 31, 1944.

(1) This term was used from August 1, 1941 to February 28, 1944 during which 94.2% of the total aircrew candidates during the entire period were examined.

(2) This does not include all cases rejected on the enlistment x-ray due to evidence of pulmonary tuberculosis.

(3) As from March, 1942.

disqualifying defects per 1,000 men, 128 men per 1,000 examined had a disqualifying visual defect (visual acuity, 63; colour vision, 45; other eye defects, 20); 14 per 1,000 had a hearing or ear defect; 23 had a cardiovascular condition; 20 had a nasal or respiratory condition; 14 had a digestive disorder (hernia, 7); 11 had a nervous or mental condition and 8 had a disqualifying orthopædic impairment (Table IV).

In 128,204 groundcrew, visual defects were the leading cause of rejection (20.4%); digestive disorders ranked second with 14.6%; cardiovascular defects contributed 13.4%; orthopædic impairments, 10.2%; hearing and ear defects, 9.9%; nasal and respiratory conditions, 9.0%; nervous and mental disorders, 4.5% (Table V).

Among the 23,278 W.D. candidates, visual defects were responsible for 14.1% of the disqualifying defects; cardiovascular defects contributed 12.1%; nervous and mental disorders, 9.5%; orthopædic impairments, 7.7%; hearing

TABLE V.

DISQUALIFYING DEFECTS FOUND AMONG GROUNDCREW CANDIDATES*
PERCENTAGE DISTRIBUTION AND PREVALENCE PER 1,000 CANDIDATES

| *Causes of rejection* | *Number causes of rejection* | *Percentage of total causes* | *Rate per 1,000 candidates* |
|---|---|---|---|
| *Eye defects* | | | |
| Defective colour vision | 137 | 0.6 | 1.1 |
| Defective visual acuity | 4,372 | 18.0 | 34.1 |
| Other eye conditions | 432 | 1.8 | 3.4 |
| *Ear defects* | | | |
| Defective hearing | 897 | 3.7 | 7.0 |
| Otitis media and mastoiditis | 1,071 | 4.4 | 8.4 |
| Other ear conditions | 444 | 1.8 | 3.5 |
| *Diseases of the circulatory system* | | | |
| Abnormalities of blood pressure | 662 | 2.7 | 5.2 |
| Organic heart disease | 1,501 | 6.2 | 11.7 |
| Varicose veins and varicocœle | 846 | 3.5 | 6.6 |
| Other diseases of the circulatory system | 245 | 1.0 | 1.9 |
| *Diseases of the respiratory system* | | | |
| Deviated septum, nasal obstruction | 324 | 1.3 | 2.5 |
| Other nasal conditions | 616 | 2.5 | 4.8 |
| Other respiratory conditions (not tbc.) | 1,259 | 5.2 | 9.8 |
| *Diseases of the digestive system* | | | |
| Dental defects and conditions | 212 | 0.9 | 1.7 |
| Hernia | 1,724 | 7.1 | 13.4 |
| Peptic ulcer | 912 | 3.7 | 7.1 |
| Other diseases of the digestive system | 696 | 2.9 | 5.4 |
| *Nervous and mental disorders* | | | |
| Mental disorders (excluding epilepsy) | 373 | 1.5 | 2.9 |
| Other diseases of the nervous system | 733 | 3.0 | 5.7 |
| *Orthopædic impairments* | | | |
| Flat feet | 891 | 3.7 | 6.9 |
| Other foot defects | 993 | 4.1 | 7.7 |
| Lost members | 155 | 0.6 | 1.2 |
| Other orthopædic impairments | 432 | 1.8 | 3.4 |
| *Genito-urinary conditions* | 790 | 3.2 | 6.2 |
| *Others* | | | |
| Arthritis and rheumatism | 498 | 2.0 | 3.9 |
| Underweight | 496 | 2.0 | 3.9 |
| Diseases of the skin | 443 | 1.8 | 3.4 |
| Tuberculosis | 319 (1) | 1.3 | 2.5 |
| Overweight | 144 (2) | 0.6 | 1.1 |
| Diabetes mellitus | 137 | 0.6 | 1.1 |
| Venereal disease | 96 | 0.4 | 0.7 |
| Other disqualifying defects n.s.e. | 1,496 | 6.1 | 11.7 |
| Total | 24,346 | 100.0 | 189.9 |

*Based on 128,204 groundcrew candidates examined during the period August 1, 1941 to July 31, 1944.

(1) This does not include all cases rejected on the enlistment x-ray due to evidence of pulmonary tuberculosis.

(2) As from March, 1942.

and ear defects, 6.6%; digestive disorders, 3.8%; menstrual disorders, 5.7%; underweight or overweight, 10.9% (Table VI).

There were variations in the distribution and prevalence of disqualifying defects during the period; these were associated with changes in physical standards during the course of the war. The figures presented therefore would have been quite different and the rates much higher for some items had the initial medical standard been adhered to throughout the war.

## DISCUSSION

These wartime data emphasize some important facts for the future. A large proportion of the male population of flying age is unfit for aircrew training according to prevailing medical standards. Visual defects rank first as a cause of rejection and among aircrew candidates they account for over half of all disqualifying defects. The data which have been presented also show clearly that, under a system of voluntary enlistment, the medical re-

TABLE VI.

DISQUALIFYING DEFECTS FOUND AMONG WOMEN'S DIVISION CANDIDATES*
PERCENTAGE DISTRIBUTION AND PREVALENCE PER 1,000 CANDIDATES

| *Causes of rejection* | *Number causes of rejection* | *Percentage of total causes* | *Rate per 1,000 candidates* |
|---|---|---|---|
| *Eye defects* | | | |
| Defective colour vision | 4 | 0.1 | 0.2 |
| Defective visual acuity | 611 | 12.9 | 26.2 |
| Other eye conditions | 51 | 1.1 | 2.2 |
| *Ear defects* | | | |
| Defective hearing | 92 | 1.9 | 4.0 |
| Otitis media and mastoiditis | 151 | 3.2 | 6.5 |
| Other ear conditions | 72 | 1.5 | 3.1 |
| *Diseases of the circulatory system* | | | |
| Abnormalities of blood pressure | 138 | 2.9 | 5.9 |
| Organic heart disease | 354 | 7.5 | 15.2 |
| Varicose veins and varicocœle | 51 | 1.1 | 2.2 |
| Other diseases of the circulatory system | 30 | 0.6 | 1.3 |
| *Diseases of the respiratory system* | | | |
| Deviated septum, nasal obstruction | 21 | 0.4 | 0.9 |
| Other respiratory conditions (not tbc.) | 250 | 5.3 | 10.7 |
| *Diseases of the digestive system* | | | |
| Dental defects and conditions | 39 | 0.8 | 1.7 |
| Hernia | 26 | 0.6 | 1.1 |
| Peptic ulcer | 22 | 0.5 | 1.0 |
| Other diseases of the digestive system | 89 | 1.9 | 3.8 |
| *Nervous and mental disorders* | | | |
| Mental disorders (excluding epilepsy) | 131 | 2.8 | 5.6 |
| Other diseases of the nervous system | 315 | 6.7 | 13.5 |
| *Orthopædic impairments* | | | |
| Flat feet | 129 | 2.7 | 5.5 |
| Other foot defects | 135 | 2.8 | 5.8 |
| Lost members | 11 | 0.2 | 0.5 |
| Other orthopædic impairments | 97 | 2.0 | 4.2 |
| *Genito-urinary conditions* | 152 | 3.2 | 6.5 |
| *Menstrual disorders* | 268 (1) | 5.7 | 11.5 |
| *Diseases of the thyroid gland* | 200 (1) | 4.2 | 8.6 |
| *Others* | | | |
| Overweight | 262 (2) | 5.5 | 11.3 |
| Underweight | 258 | 5.4 | 11.1 |
| Diseases of the skin | 99 | 2.1 | 4.3 |
| Tuberculosis | 64 (3) | 1.4 | 2.8 |
| Arthritis and rheumatism | 49 | 1.0 | 2.1 |
| Diabetes mellitus | 31 | 0.7 | 1.3 |
| Venereal disease | 22 | 0.5 | 0.9 |
| Other disqualifying defects n.s.e | 513 | 10.8 | 22.0 |
| Total | 4,737 | 100.0 | 203.5 |

*Based on 23,278 Women's Division candidates examined during the period September 1, 1941 to August 31, 1944.

(1) As from April, 1942.

(2) As from March, 1942.

(3) This does not include all cases rejected on the enlistment x-ray due to evidence of pulmonary tuberculosis.

jection rate increased significantly with time despite considerable relaxation of physical standards as the war progressed. This reflects a worsening of the physical status of the total manpower in the forces; it means that under the voluntary enlistment program with initially high medical standards, the physical cream was first removed from the manpower pool.

A careful examination of these data emphasizes the reality that a substantial portion of the "causes of rejection" are not diseases, but physiological changes and developmental defects which are not preventable.* This fact suggests that the "physical fitness" of persons of military age in this country is not as poor as published data might easily lead the less critical observer to conclude. Perhaps more important, this observation also indicates that present standards should be subjected to critical re-examination as valid criteria of physical fitness for any task.

We shall no doubt add a good deal to our knowledge of the ideal educational and psychophysical standards for flying and other military personnel in all trades and classifications, but, in thinking about and drafting standards, we should be mindful that in another war we may well be faced with explicit direct assignment of manpower. This means surely that our total manpower potential must be known beforehand and a clear-cut decisive fixed plan made effective at once, based on ultimate manpower potential in lieu of the customary policy of taking the most easily accessible and physically most favourable groups first.

These observations support the fundamental idea that a wartime physical standard—age, education, as well—should be set at the outset in such a way to obviate the need for making repeated changes in standards in order to get the required number of personnel to man the required units. In other words, shake the bottle briskly at the outset and avoid the policy of removing the cream first. In this way uniform quality is assured and many training problems eliminated as well.

## CONCLUSIONS

There are few medical data on the fitness of men of military age generally for flying or other tasks. Aviation Medicine demands, as a peacetime requirement, a program which ensures the collection of adequate data on physical fitness in the population of military age. The setting of physical standards for any task, for any system, is influenced necessarily by two things—the demand for personnel and the available supply. Aviation Medicine should know, therefore, the precise effect on recruitment of any given set of physical standards!

In medical planning or in general planning, sight must not be lost of the simple fact that the sustaining manpower reserve in Canada is made up of the 115,000 men reaching age 18 each year. The relatively high rejection rates observed under a system of voluntary enlistment during the last war therefore suggest the necessity of establishing the validity of each physical standard, and of assuring ourselves that our medical standards are not in fact being held too high.

The Medical Services of the Armed Forces should undertake to be continually aware of the physical fitness for service at each age, educational grade, and occupational level in the country. To achieve this, carefully designed sampling studies should be undertaken in which complete physical examinations are carried out. With the data thus collected a fair guide would be afforded for a precise study of the influence of any standard or set of standards and for consideration of the problems of personnel assignment by service and trade.


## RÉSUMÉ

La médecine du corps d'aviation a besoin pour le temps de paix d'un programme qui assurera la compilation d'information suffisante sur les aptitudes physiques de la population d'âge militaire. L'établissement de standards physiques pour une tâche est nécessairement influencés par deux choses: la demande pour le personnel et le matériel disponible. La médicine du corps d'aviation doit connaître l'effet précis sur le recrutement, d'un ensemble donné de standards physiques.

Le Canada ne dispose que de 115,000 hommes d'âge militaire chaque année. Pendant la dernière guerre le taux relativement élevé de refus pour causes médicales sous le système d'enrôlement volontaire suggère une vérification de nos standards physiques actuels afin de nous assurer qu'il ne sont pas trop élevés. Les services médicaux des forces armées devraient être au courant des aptitudes physiques pour les différents services, pour tout âge, degré d'éducation et niveau occupationnel au Canada. Avec les examens faits et les informations obtenues nous aurions un guide sûr permettant une étude précise sur l'influence d'un standard ou d'un groupe de standards. Ceci aiderait dans les problèmes de nomination de personnel pour les différents services.

YVES PRÉVOST


* Among aircrew candidates, colour blindness and defective visual acuity were responsible for 43.5% of all disqualifying defects recorded in aircrew candidates (Table IV). Neither of these defects is due to disease in the true sense of the word.

# TREATMENT OF ACUTE URÆMIA DUE TO OLIGURIA AND ANURIA*

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FOR the rational treatment of acute uræmia a conception of normal renal function and of the mechanisms by which anuria may be produced is necessary.

In the normal kidney an adequate blood flow and blood pressure is essential for the formation of urine. It has been shown by the diodrast plasma clearance method that the renal blood flow is copious—about 1,300 c.c. per minute, or nearly one-third of the cardiac output. Practically the whole of this volume courses through the glomerular tufts. The renal artery is short, arises directly from the aorta and is very large in relation to the amount of tissue which it supplies. It rapidly divides up into short, relatively wide, vessels the lumen of the afferent glomerular arterioles being about 50 microns in diameter. By this vascular arrangement a rich supply of blood is delivered to the loops at a high head of pressure, the diastolic capillary pressure being estimated at 20 cm. of water or over 50% of the systolic aortic pressure. As a result of this anatomico-physiological mechanism the glomeruli filter off about one-fifth of the plasma which is presented to them, the process being a physical one regulated by capillary pressure, plasma osmotic tension, capsular tension and the permeaability of the glomerular membrane. Alterations in the supply of blood or of the blood pressure are obviously important as possible causes of anuria. The renal arteries and their branches, as is well known, are richly supplied with autonomic nerves and Trueta[1] has shown by a number of experiments that, on reflex or direct stimulation of these nerves, not only does the whole renal blood flow become markedly diminished as a result of vaso-constriction but that the peripheral two-thirds of the cortex becomes ischæmic, the reduced total blood supply being by-passed through the juxta-medullary glomeruli and medulla which shows engorgement. Ischæmia of this order is considered to be very detrimental to nephric tissue. Badenoch and Darmady[2] have expressed the opinion that six hours vascular occlusion may cause irreparable renal damage in man. Apart from a localized vascular reaction such as this hæmorrhage, shock and dehydration are also factors which may diminish glomerular filtration by lowering the head of pressure.

The filtrate, which normally is in the vicinity of 80 litres per day, after being modified and concentrated in its course through the tubules, is transmitted to the renal pelvis. Therefore, anuria must be caused by either a suppression of filtrate, blockage of all the tubules or both ureters or complete reabsorption by tubular epithelium. Although the pathogenesis is not yet established, two main theories emerge, *viz.*, renal anoxia and nephrotic tubular injury. The noxious influence responsible for anuria, whatever it may be, is apparently transient in its action and may be likened to a hail storm, leaving damage in its wake. This is shown by the reparative changes which are regularly to be observed on the fourth and fifth days and to be completed generally within two weeks of onset. Consequently, death or recovery may be expected within as short a time as twenty days. For example, in Lucké's series of 100 cases 95% died within 14 days, 86% within 10 days and 48% within 6 days, no death occurring after twenty days. And so, in considering treatment we see the importance of tiding the patient over the critical ten day period.

## SUPPORTIVE TREATMENT

Shock and hæmorrhage, which not infrequently are forerunners of anuria, should be treated by blood or plasma transfusion in order to maintain blood pressure. Moreover, rapidly reduced blood volume of itself can cause functional renal impairment and azotæmia. Severe traumatic hæmorrhage accelerates protein metabolism and promotes a rise in blood urea and potassium. Infection does precisely the same thing, so that it is very important to make full use of any necessary antibiotic treatment. Dehydration disturbs the blood chemistry and should be corrected if present.

The most important therapeutic responsibility on the part of the physician is to maintain a normal internal environment and especially to avoid death by drowning. In the literature it is commonplace to encounter case histories in which death has been immediately preceded by the appearance of generalized œdema and signs of pulmonary congestion. Such a case report by Clarke and Fitzgerald[4] appears as recently as November, 1948, in which two and a half litres of 5% glucose in distilled water were given per day, followed by death due to pulmonary œdema.

In the normal subject the average fluid intake is 2.5 litres and the non-renal loss is two-fifths of this volume, or 1 litre. It would seem that the replacement of this amount would be required to maintain fluid balance. Strauss,[5] however, points out that preformed water and water of oxidation from endogenous metabolism amounts to almost 0.5 litre so that he postulates the use of only 750 c.c. of 15% glucose in distilled water. This method provides a total of 1,250 c.c. of water per day for extrarenal loss. Glucose is given to combat acidosis and sodium chloride is withheld since there is no chloride loss in the absence of vomit-

* Read before the Vancouver Medical Association, February, 1949.

ing. The requisite amount of glucose to be given intravenously is in the vicinity of 100 grams per day. Butler[6] and also Winkler[7] have demonstrated that this amount will reduce protein catabolism by almost 50% and consequently the concentration in the blood non-protein nitrogen, potassium, sulphate and phosphate, by-products of cellular catabolism, will be inhibited to a like degree. So the development of uræmia will be retarded.

Vomiting, a prominent feature of acute uræmia, may cause an appreciable loss of chloride which must be replaced parenterally. Hypochloræmia, therefore, should be watched for. The tendency to low blood chloride values comes out in various case histories even before the onset of diuresis in the recovery state, when the urinary chloride output is usually considerable. It is an established pathological feature that the tubules, owing to their damaged condition, cannot reabsorb chloride though the level in the blood be low.

As has been mentioned the continued breakdown of tissue cells leads to a rise in serum potassium—an element of paramount importance. Assuming that the patient, as a result of sufficient dextrose and appropriately regulated fluids, has escaped the Scylla of death by transfusion in the first few days, he is confronted with the Charybdis of potassium poisoning at about the end of the first week. There is a tendency for serum potassium levels to rise and this hyperpotassæmia makes intelligible the fatal termination in a number of cases of uræmia which previously baffled explanation. The recognition of this state is of importance. Certain clinical symptoms suggest it, *viz.*, paræsthesias of the hands and feet, sudden weakness of the extremities and shock-like syndromes. There are no unmistakable clinical signs however, and proof rests upon a characteristic electrocardiographic pattern or an increased concentration of potassium in the blood.

The electrocardiographic changes which are indicative of toxic myocardial effects are in general in the following order of appearance: increased height of T-waves, increased width of QRS complexes, loss of P-waves, gross intraventricular conduction defects simulating bundle branch block and cardiac arrest with irregular undulating low potentials. These toxic effects have been found to occur at very variable levels of potassium in the blood and the increase of concentration of potassium in the cardiac muscle has also been found to vary considerably. In Keith's[8] series the values ranged from 7.7 to 10.5 milliequivalents per litre. Intoxication is usually of short duration and may appear as a manifestation of the terminal stage. Time for instituting remedial measures is of necessity brief once these findings are evident. Consequently an electrocardiogram should be made every day. Bywaters[9] noted that glucose and insulin bettered the electrocardiographic pattern in Crush Syndrome. Finch and Marchand[10] changed the pattern towards normal by injecting calcium salts but, if renal insufficiency continued, the patterns of potassium toxæmia recurred and cardiac standstill developed. The intravenous administration of calcium, an element which has an action on heart muscle opposite to that of potassium may be expected to temporarily relieve the threat of asystole.

If acidosis should become clinically manifest and be confirmed by laboratory data it may be counteracted by the administration of one-sixth molar sodium lactate. If the preservation of the internal environment appears to be satisfactorily maintained one may await spontaneous diuresis. Other methods to produce diuresis appear for the greater part to be ineffectual. Procaine blockage of the sympathetic nerve supply to the kidney, in order to relieve vascular spasm, is rational and worthy of trial. J. C. White[11] states that he has done it often but never with a successful result. Spinal anæsthesia has been carried out but is capable of lowering the blood pressure. Intravenous diuretics such as copious hypertonic glucose solutions, hypertonic saline and hypertonic sodium sulphate solutions do more harm than good. This applies also to mercurial diuretics. Potassium salts should not be used on account of the risk of toxicity. Decapsulation of the kidneys, although there are certain protagonists for this method, such as Peters,[12] is not favourably regarded by the majority. It is true that in some cases decapsulation apparently relieved renal tension and has been followed by diuresis. For instance, Reid[13] and others stated "the left kidney (when incised) almost exploded and pieces of friable tissue were taken for microscopy." Such reports are not convincing, however, because diuresis has occasionally followed various procedures which are usually ineffectual and, indeed, has taken place in the absence of any treatment whatsoever. Furthermore, both kidneys have been found to secrete when only one was decapsulated. If œdema of the body generally is avoided in the first place, œdema of the kidney will not be so likely to occur. Hot packs to the loins and artificial fever produced by intravenous typhoid vaccine would appear to be methods of desperation. As regards attempts at alkalinization of the urine, Mallory[14] considers that it does harm. He has cited three cases in which alkalosis was produced but the urine remained acid. Alkali will not go through the kidneys

once the lesion is established. Ureteral catheterization with renal pelvic lavage with the object of relieving obstruction and stimulating the kidney should be utilized where sulfonamides are responsible for the anuria because it is impossible to determine whether crystals blocking the outlet are responsible. This was plainly exemplified by a case which came under the care of Dr. K. Telford[15] quite recently. A girl of sixteen developed complete anuria about 42 hours after the commencement of treatment with sulfmerazine. In due course, with the idea of carrying out a splanchnic block, a long needle was introduced and, on aspirating, urine was recovered. This proved that a complete parenchymal shutdown was not wholly responsible for the anuria. Introduction of ureteral catheters immediately yielded a good urinary flow.

By observing the regimen as outlined it will be possible to keep the majority of patients alive until the kidneys recover spontaneously and the retention of excretory products is reversed. Marshall and Hoffman[16] have reported complete recoveries in four patients out of six, the fifth had a residual renal lesion and the sixth died in uræmia with heart failure five days after diuresis had set in. It is to be remembered that the majority of patients who survive for ten days recover.

### TREATMENT BY DIALYSIS

If diuresis fails to supervene, however, and if the uræmia progresses to a precarious degree it may become necessary to resort to one or other form of treatment by dialysis. Established methods of dialysis are: (1) Peritoneal irrigation (Ganter 1923). (2) Artificial dialysers such as those of Kolff, Almer, or Abel (1914). (3) Intestinal perfusion through an isolated loop or through the undisturbed bowel.

The employment of any of these methods is not to be undertaken lightly and demands that the delicate balance of blood chemistry and water metabolism be closely observed lest measures to reduce the amount of blood urea and metabolites may so disturb general metabolic processes that life is endangered rather than protected by the enthusiastic therapist.

Peritoneal irrigation has been performed with success, large volumes, as great as 20 to 35 litres per day of Tyrode's solution with penicillin added, having been run into a mushroom catheter on one side of the abdomen and drained off on the opposite side through a stainless steel sump with suction: 15 to 20 grams of urea per day may be removed by this method. The disadvantages are the risk of peritonitis, the formation of abdominal adhesions with tunnel and loculation formation and the necessary surgical performance.

Artificial kidneys in the form of cellophane dialysers have met with success but the use of these apparatuses requires much technique and very detailed attention. Another disadvantage is the necessity for heparinization which militates against their use in post-surgical anuria. Again, the method creates an arteriovenous shunt which may place a dangerous load on an already diseased heart or one which is in danger of being rapidly affected by hyperpotassæmia. In children too this method is not very suitable because of the subject's relatively small blood volume. On account of the cardiovascular strain involved it is usual to employ the apparatus for periods of six hours or so for a limited number of days. In spite of these difficulties it has proved of value in clinics adequately staffed and may have a definite place in treatment although such an apparatus is not generally required in the usual case of lower nephron nephritis.

Perfusion of an isolated loop of small bowel may prove successful in combating uræmia but this method was tried by Kolff before he perfected the dialyser. The segment of bowel is apt to become atonic and may even rupture, and in any case the procedure involves a double iliostomy with the necessary subsequent closure.

A method of extrarenal filtration of waste metabolites has latterly come into use which appears to be the most expedient, *viz.*, perfusion of the intact bowel by means of a double tube such as the Wilson-Sawyer tube; that is, a tube 108 inches in length with a shorter duodenal tube of 36 inches attached. The object is to run perfusate into the shorter tube and aspirate it through the tube placed 72 inches lower in the small bowel. In actual practice this method has proved effectual but the aspiration has not been efficient, about half the fluid being evacuated as profuse watery stools. Black and Stanbury[17] have simplified this method still further by using one tube in the duodenum and another in the rectum and this is the method of choice. With this set-up 7 to 10 litres of

4.5% solution of sodium sulphate may be run through the bowel per day with the removal of 15 grams or more of urea. Although this removal of urea is an index of the diffusibility of metabolites through the bowel wall it must be remembered that electrolites can pass also and since sodium chloride and calcium may be removed, a watch must be kept on the chloride and calcium values of the blood. So effective is this method in the washing out of potassium that Marquis and Schnell[18] after ten days of intestinal dialysis by perfusion, found the serum potassium to be reduced to 1.2 milliequivalents per litre, the case terminating in sudden death before the situation was realized. If the degree of uræmia, and more especially of hyperpotassæmia, warrants the use of dialysis it is essential to check the electrolytes and acid-base balance of the blood as well as the blood urea or non-protein nitrogen. If any of these factors are found to be deficient they may be administered through the duodenal tube mentioned previously during periods when perfusion is discontinued.

The accumulation of excretory products in the body is preventable by attaining 10% of the average normal maximum renal urea clearance value which is 75 c.c. per minute. Therefore perfusion need not be continued when recovery of renal urea clearance equals 7.5 c.c. per minute. The onset of diuresis is sudden or gradual and may be considered to have eventuated when the output excedes 500 c.c. per day. Excretion may reach very high levels, as much as nine litres per day. The blood urea falls although quite slowly for the first few days. The urine is of low specific gravity and is practically a glomerular filtrate without glucose. The kidney shows little ability to conserve chloride and so chloride loss is considerable. Therefore, at this stage, the volume of urine and its chloride content should be estimated for the purpose of administering equivalent quantities of both substances together with an extra litre of water to the patient. Anæmia, due to bone marrow depression, may develop during the diuretic phase and should be corrected by blood transfusion.

Full renal recovery is tardy and may not be complete for from three to seven months as determinated by mannitol, p'amino-hippurate, urea and creatine tests.

## CASE REPORT

A male, aged 66, was subjected to thyroidectomy and was given an incompatible blood transfusion on February 12, 1949. He developed oliguria (240 c.c. per day) in the immediate postoperative period and the condition became established (see Table I). When first seen on February 16, 1949, the fourth day of oliguria, he was already œdematous, having received 8 litres of fluid intravenously and over seven litres by mouth since the operation, but there were no basal pulmonary râles. The hæmoglobin was 57%, serum potassium 10.2 mgm. %, non-protein nitrogen 118 mgm. % and $CO_2$ combining power 49.5 vol. %. The blood pressure was 150/70 and his general condition fair. A blood transfusion of 1 litre was given and his fluid intake regulated at 500 c.c. per day, plus an amount equivalent to the scanty urinary output, in order to reduce the œdema; 100 grams of glucose was administered together with thiamine chloride.

The patient's condition remained fair but on February 20, the eighth postoperative day, the serum potassium was found to be elevated to 29 mgm. %. The non-protein nitrogen had risen to 243 mgm. %. Intestinal perfusion was decided upon and, on the next day when the patient was noted to have some disorientation, a duodenal and a rectal tube having been placed in position, 10,400 c.c. of 4.5% solution of sodium sulphate were run in through the duodenal tube during a period of seven hours. Drainage from the rectal tube appeared within one hour of starting and the total rectal fluid recovered (by drainage into a receptacle) amounted to 11,200 c.c., an excess over intake of 800 c.c. This fluid

TABLE I.

| Date | Serum K mgm. % | N.P.N. mgm. % | $CO_2$ Cmbq. | Hb % | Urine Vol. ml. | Blood trans. L. | $Na_2SO_4$ perfused L. | Dialysate Vol. L. | Dialysate Urea mgm. % |
|---|---|---|---|---|---|---|---|---|---|
| February | | | | | | | | | |
| 16 | | 92 | 49.5 | 57 | 30 | 1.0 | | | |
| 17 | 10.2 | | | 68 | 90 | 0.5 | | | |
| 18 | | 118 | 56.0 | 80 | 330 | 0.5 | | | |
| 19 | | 193 | 53.7 | 85 | 300 | | | | |
| 20 | 29.0 | | | | 180 | | | | |
| 21 | | 243 | | | 300 | | 10.4 | 11.2 | 168 |
| 22 | 17.4 | | | 84 | 120 | | 9.5 | 12.6 | 149 |
| 23 | | 210 | | | 450 | | | | |
| 24 | 24.0 | 189 | | | 515 | | | | |
| 25 | | | | | 2175 | | | | |
| 26 | | 228 | | 70 | 2160 | 0.5 | | | |
| 27 | | | | | 2660 | 0.5 | | | |

contained 19 grams of urea. The serum potassium was reduced to 17.4 mgm. % but this result was not available until a further perfusion of 9.5 litres, with 12.6 litres of perfusate recovered, had been carried out on the next day, February 22. Sufficient fluids were given by mouth after each treatment to compensate for the dehydration. The blood pressure had dropped to 105/70 and a few twitches were noticed. As the serum calcium was found to be 8.2 mgm. % 10 c.c. calcium gluconate were given intravenously. Within six hours the blood pressure had returned to 135/80. As the blood chemistry appeared to be satisfactorily maintained no further dialysis was used. On February 24, the 12th day of oliguria, 550 c.c. of urine was excreted. This was followed by 2,175 c.c. on the next day and marked clinical improvement was noted with this diuresis. This urine was of low specific gravity and contained 8 grams per litre of sodium chloride. This chloride loss was replaced by giving NaCl tablets by mouth. The clinical improvement continued and the non-protein nitrogen fell to 118 mgm. % on the 19th day of the illness and to 58 mgm. % on the 25th day. Progress was uneventful but recovery of strength and feeling of well-being was very gradual and hardly perceptible from day to day.

## COMMENT

It will be noted that the total fluid recovered was greater than that of the sulphate solution introduced. Dehydration is to be combated by means of giving water through the duodenal tube after dialysis is discontinued or during rest periods. Chloride in this case was not washed out, as the blood sodium chloride concentration after dialysis was 558 mgm. % whereas the potassium concentration was reduced. Dialysis may be used for shorter periods than in this case and as often as is required in one more protracted.

## SUMMARY

The importance of an adequate blood supply to the kidney is reviewed.

Shock, hæmorrhage, dehydration, infection and hypochloræmia impair renal efficiency and should be remedied.

The pathogenic influence in lower nephron nephrosis is brief in its action and rapid repair may be anticipated.

Protein catabolism is minimized by giving 100 grams of glucose daily together with sufficient water to replace non-renal loss. The aim of treatment is to preserve the internal environment until spontaneous diuresis occurs.

Hyperpotassæmia is dangerous and may be diagnosed by biochemical and electrocardiographic methods.

Extrarenal filtration of metabolites may be required at times but the usual case of lower nephron nephrosis should not require it. If it is required simple perfusion of the bowel is the most expedient and practical method.

Complete renal recovery is slow but in almost all cases is accomplished.

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## RÉSUMÉ

L'auteur rappelle l'importance d'un flot sanguin suffisant au niveau des reins, énumère les principales causes de l'anurie et les états pouvant la précipiter. Il établit une ligne de conduite à suivre en attendant la diurèse. L'équilibre du milieu intérieur doit être maintenu et l'auteur met en garde contre l'administration de solutés intra-veineux en trop grande quantité. Il préconise à la suite de Strauss l'emploi de 750 c.c. d'eau distillée glucosée à 15% pour remplacer les pertes extra-rénales, et restreint l'administration des chlorures en l'absence de vomissements. Il recommande de surveiller l'hyperpotassémie facilement décelable par l'E.C.G. et les analyses chimiques du sang. L'acidose une fois installée est controlée par le lactate de Na. Les méthodes usuelles pour déclancher la diurèse *i.e.* le bloquage splanchnique, la rachi-anesthésie, la décapsulation sont passées en revue et leur valeur respective établie.

Si la diurèse ne se produit pas et que l'urée a tendance à monter il faudra procéder au traitement par dialyse *i.e.* l'irrigation péritonéale, le rein artificiel, et la perfusion intestinale. La première n'est pas pratique à cause de la formation d'adhérences et le danger d'infection. Les reins artificiels sont très utiles mais demandent un personnel entrainé. La perfusion intestinale semble actuellement être la plus facile d'application. Elle peut se faire au moyen d'une anse isolée ce qui cependant amène des complications. L'autre façon consiste à introduire un tube jusqu'au duodénum et à receuillir la solution 6 pieds plus bas ou tout simplement au rectum. L'auteur se sert d'une solution de sulfate de Na à 4.5%. Le prognostic en général est bon quand la 10e journée est passée. YVES PRÉVOST

## ERRATUM

The price of "Radiology Physics" by J. K. Robertson listed as $2.50 in our October book review columns is incorrect. This should read $6.00.

## IF AN ATOMIC BOMB SHOULD FALL*

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THE problem of what should be done in the event of an atomic war is just as important to the civilian doctor as to the army doctor. Although in the event of attack no doubt martial law would be immediately declared, and organized relief would eventually be under the control of military personnel, there is no doubt that much of the burden would fall upon civilian doctors and civilian relief workers. It therefore behooves the medical profession to be well informed of the problems involved and to have some knowledge of necessary relief organizations under the specific conditions of an atomic bomb explosion.

To get a diagrammatic picture of the extent of forces and effects of one atomic bomb explosion in the air above a large city, we might construct a diagram having four concentric circles representing one mile, 2 miles, 3 miles and 4 miles from the explosion centre. By drawing three radii the diagram may be divided into three sectors: one representing explosion damage having an internal angle of 150°, one representing thermal damage having an angle of 139° and the other representing radiation damage and having an angle of 71°. The size of these sectors then gives an idea of the ratio of the three classes of injuries caused by an atomic bomb namely wounds, burns and radiation injuries. Jagged circular lines may be added to indicate the distance damaging forces are effective. In the explosion damage sector one may show very heavy building damage up to 3/4 miles from the centre, heavy building damage up to 1½ miles, moderate building damage up to 2½ miles and slight building damage up to 3½ miles.

In the thermal sector flash burns may be indicated up to a distance of 2½ miles. Secondary fire damage may be represented up to 1½ miles in all directions but much farther in the direction of the wind. In the radiation damage sector the distance to which lethal doses of radiation may extend may be represented by a curved line at a little over a mile from the centre, the range of sublethal but damaging radiation by a curved line a little under 2 miles from the centre and the range of measurable effects by a curved line 3 miles from the centre. A large indefinite area may be added to represent the area of "fall out" of radioactivity which may extend in the direction of the wind up to 50 miles or so.

Based on experience in Japan, it is probable that in a large city in Canada there would be approximately 50,000 killed outright and something like 60,000 injured if an atomic bomb were well placed when it exploded. One can readily see what an impossible task it is to adequately care for such a large number of casualties. However, if one has some understanding of the situation and some planning is made in advance, a very satisfactory attempt can be made. Before suggesting plans for handling casualties, let us think for a moment of the types of injuries.

Explosion injuries are of two types: (1) Blast injuries which are due to the compression wave of the explosion itself. The nature of an atomic bomb explosion is such that there will probably be none or very few which are purely this type of injury. (2) Secondary injuries due to falling buildings and flying fragments of debris such as glass, stone, fragments of buildings, etc. These injuries will be by far the most numerous and will occur anywhere within 3½ miles of the explosion centre. Probably something like 70% of injured people treated will be suffering from wounds of this kind. The atomic bomb does not cause injuries due to flying fragments of the bomb casing as is found with high explosive bombs. This is probably because the intense heat of the explosion turns the casing to vapour.

Thermal injuries may be divided into two classes: (1) Flash burns which are caused by the intense burst of heat or infra-red rays given off by the atomic bomb at the time of explosion. Flash burns will affect people in the open up to a distance of 2½ miles in all directions. (2) Secondary burns are burns received in secondary fires. Large numbers of fires are started as a result of over-turned stoves, liberation of gas, etc. Some fires no doubt are started by the intense heat from the bomb itself. Most of the burns received will be secondary burns and many of the deaths will be due to burns where people are trapped and burned with the building. Something like 65% of all patients treated will probably have some burns.

* NOTE—Limited to air burst and standard Hiroshima or Nagasaki bomb.

Ionizing radiation injuries may be divided into three classes: (1) Primary, which are radiation injuries received at the moment of explosion of an atomic bomb; they are due to intense radiation with large numbers of gamma rays and neutrons. Practically all of the radiation injuries are primary. It is not necessary to be directly in the open to receive primary radiation injuries since these rays may be reflected off walls, floors, etc., and be scattered in sufficient numbers to cause radiation injury. (2) Secondary radiation injuries are those caused by induced radiations. Induced radiation is the radiation given off by a metal which has become bombarded by neutrons so that it becomes radioactive. Probably in an atomic bomb explosion very few people would receive significant injury from secondary radiation of this kind. In the first place, secondary radiations are not, by any means, as intense as the radiations from the atomic bomb and to receive damaging amounts one would have to be quite close to this type of induced radiation for some considerable time. (3) Tertiary injuries. When an atomic bomb explodes, not all of the original plutonium or uranium is destroyed so that these radioactive substances along with a large number of radioactive fission products are scattered and fall to the ground near the area of explosion and for great distances down wind. This residue of radioactive substances gives us the term "residual radiation". These radioactive residues are particularly dangerous when taken into the body by inhalation and by ingestion. Radiation injuries due to residual radiation, however, will be few and will not develop immediately.

Something like 35% of all patients treated will have some degree of radiation injury. It must be remembered that many patients will have both burns and wounds or burns and radiation sickness or any combination. Many people within the lethal range of gamma rays will die later irrespective of other injuries unless they have been shielded by stone or concrete or metal of considerable thickness.

All people within the dangerous dose area will develop various degrees of radiation sickness which is dependent upon the total amount of ionizing radiation received. Here again the amount of shielding will be an important factor. Radiation injuries will not be found beyond two miles from the epicentre but various degrees of burns and mechanical injuries will be encountered beyond the two-mile range.

Now we have some conception of the magnitude of the problem presented by an atomic bomb explosion in a heavily populated area. In planning medical services and rescue work there are many additional difficulties which will be encountered. There will be widespread disruption in transportation facilities, electrical services, telephone and telegram facilities, etc. Probably the water system will remain intact because an atomic bomb exploded in the air does not penetrate the ground sufficiently to damage the water mains at their ordinary depth. The filtration plant itself, of course, may be badly damaged but otherwise the effect on water supply will only be a great lowering of pressure because of broken house supply pipes. Consideration should be given as to whether or not the water will be fit to use. Much depends upon the position of the water supply and whether or not it is filtered. A large part of the particulate matter coming from an atomic bomb would be removed by the filtration process and filtered water would probably be quite safe to use, whereas unfiltered water, particularly if taken from a reservoir which was in the fall-out area, would probably be quite unsafe to use.

The sewage system of a city would still probably be intact but would soon become contaminated if a rain followed the atomic bomb explosion, washing radioactive substances into the sewage system.

Furthermore, all food in the bombed area must be suspected of radioactive contamination because of exposure to falling dust and particularly down wind for a considerable distance. Food in tin cans may be fit to use but must be suspected of induced radiation and should not be used until its activity is determined. If it is thought possible to use the contents of a can, the can should be carefully opened to avoid contamination of the contents by dust on the outside. Medicines, too, within the range of neutrons may become radioactive and should not be used without first determining their radioactivity. Furthermore, the patients themselves will have their clothing and bodies contaminated by radioactive particles. All medical services within a radius of three miles would almost certainly be so disrupted as to be practically useless. In organizing rescue work and caring for the injured it would be necessary to select hospitals and first aid station facilities beyond the three mile distance.

This gives some conception of the problem. To care for the injured it would be necessary to call into use all the hospitals at the periphery and for a considerable distance, probably including nearby towns. Hospitals on the down wind side in the fall-out area should not be used if it is possible to avoid it.

Handling of casualties from an atomic bomb differs somewhat from what is needed in the case of high explosive bombs. This is because of the complicating factor of contamination with radioactive substances and superimposed radiation sickness. Before patients are taken to the base hospital for treatment, they must all pass through a decontamination process which should be carried out as close to the bombed area as possible. There must be an adequate well-ventilated building or open air space with proper running water facilities. The decontamination station should be closely associated with the forward first aid station.

To carry out rescue work, decontamination and first aid treatment, it is necessary to have a trained group of men who understand the particular problems and how to deal with them. Everyone should have a healthy respect for the dangers of contamination when entering the bombed area for rescue work. However, one should have no fear, because the danger of developing radiation sickness from working within the radioactive area is negligible when proper precautions are taken.

Rescue workers should be provided with protective clothing before entering the area or should be prepared to discard their own clothing at the end of a day's rescue work. When proper organization is possible the rescue squad should operate through a proper change house. The change house should be provided with a room where rescue workers can remove all their own street clothing and store it in lockers and put on a complete outfit of rescue clothing which should be issued to them. The clothing issued should at least consist of coveralls, caps, rubber gloves, and rubber boots or rubbers which may be worn on their own shoes. It is better if underwear can also be provided. When the rescue squad goes off duty they should return to the change house, remove their clothing which was issued to them, take a thorough shower bath and then pass along to a monitoring unit where they should be examined for any significant contamination remaining on their bodies which would require more washing. If relatively free from contamination, they could then proceed to the original dressing room and put on their street clothing. The coveralls and garments removed before the shower bath should be sent to a laundry where the radioactivity could be removed by a special process.

The rescue squad, in bringing patients out of the bombed area, should take them first to a decontamination station. Here the patients should have all their clothing removed and so far as possible they should be decontaminated by the liberal use of soap and water in shower baths while standing or sitting or lying on suitable stretchers. The clothing removed would probably have to be destroyed and all of these cases would have to have some issue of protective clothing or blankets to cover them on their way to the base hospital.

Before going to the base hospital, patients requiring first aid treatment should, after decontamination, be cared for at the first aid station which should be close to the decontamination station.

The rescue squad working in the contaminated area should be instructed to render only those first aid measures which are considered life saving, such as control of hæmorrhage and some treatment for shock. There should be no blood or plasma transfusions, nor hypodermics until after the decontamination. Morphine might be administered by mouth where it is absolutely necessary.

At the first aid station after the patient has been decontaminated, some further first aid treatment might be given but no attempt should be made to suture wounds nor render anything but the most necessary first aid measures. Blood transfusions and plasma again should not be given until the patient reaches the base hospital.

At the base hospital facilities should be organized to give the best possible treatment to the largest number of people of which the hospital is capable. There will be great need for extensive laboratory work. A blood donor unit will be necessary because huge quantities of blood for transfusions will be required. Blood technicians should be mobilized and given the best facilities possible for carrying on blood counts, hæmoglobin estimations, differentials, blood typing, cross-agglutination, etc.

It will be necessary to conserve by every means, the hospital space, the doctors' and nurses' time, and above all, the blood for transfusions. It will therefore be necessary at the outset to make a careful selection of patients which will be given treatment at the base hospital. It will not be possible to treat adequately all of the patients brought into the base hospital. Therefore, no one will be able to spare time to care for the obviously fatally injured. Someone must decide that the wounds are too great to make recovery possible and place these patients by themselves. Some of the most necessary humane measures may be provided for them and if possible, some civilian might assist them in drawing up legal papers, such as wills, etc.

Segregation of fatally injured radiation cases is more difficult. It would be simple if we could say that all those coming from within one mile of the epicentre were going to die of radiation sickness anyway, then we could at once refuse these people treatment. However, many coming from that area may have been protected by sufficient shielding to make recovery possible and some laboratory means must be used to determine their further treatment.

It would be helpful if burned and wounded cases known to have been more than two miles from the epicentre could be placed by themselves, because they would all be beyond the range of ionizing radiations. These cases could be treated in the way that ordinary high explosive bomb casualties have been treated in the past, whereas cases complicated by radiation sickness require much more care and many more transfusions.

In selecting cases for intensive treatment who are known or suspected of having had dangerous doses of radiation, the most satisfactory laboratory indicator is the white cell count. If the white blood cell count is below 2,000 on the first day, the patient has almost certainly received a lethal dose of radiation and no amount of treatment will help him. Patients with a white cell count as low as 2,000 on the first day should therefore be placed among the fatally injured and no treatment given them. Those having a white cell count of over 2,000 on the first day should be given an immediate transfusion of 500 c.c. of whole blood. On the second day the white blood cells should again be counted. If on the second day, in spite of the transfusion, the white cell count is below 2,000, the patient should be abandoned because he has received too great a degree of radiation to recover. If, however, the white cell count on the second day remains above 2,000 or rises, the patient has a chance to recover and should be given all the treatment that it is possible to give him. The white cell count may fall lower on subsequent days but the patient still has a chance for recovery. It is the rapidity of the fall within the first 48 hours which has the greater significance in prognosis.

Wounds complicated by radiation sickness should be treated with extra care, because these patients have much lower resistance to infection and impaired healing power. Wounds should be excised with scrupulous aseptic technique and every precaution taken to avoid infection; skin grafting should be done early. Otherwise, the treatment of wounds and burns in the presence of radiation sickness is the same as if uncomplicated by radiation sickness.

Before describing the treatment of radiation sickness I would like to outline the signs and symptoms of the disease. In doing so, I will describe the full-blown case of radiation sickness which carries a mortality of about 50%. The signs and symptoms are divided into three periods:

In the *early period* which lasts the first day, there is nausea and vomiting and transient shock. In the *second period* lasting from the 2nd day to about the eighth day, there are no signs and symptoms of any kind. This may be described as the latent period. The patient is able to eat and sleep and go about his work as usual and has no apparent symptoms. In the *third period* from about the 8th day to the 14th day, many symptoms develop (Table I).

In addition, there are some complications and late effects which might be mentioned such as infected wounds, pneumonia, septicæmia, temporary sterilization, temporary menstrual disturbances, miscarriages, keloids and aplastic anæmia.

There will be slight variations in the symptomatology of radiation sickness in the L. 50 range with the more severe cases developing symptoms slightly earlier and the less severe developing symptoms slightly later. More severe cases of radiation sickness will not live long enough to develop the signs and symp-

toms mentioned above. These cases will probably have nausea, vomiting and shock on the first day with a rapid rise of fever which will terminate in death before other signs or symptoms develop. Milder cases of radiation sickness will develop such symptoms as diarrhœa, fever, and blood changes a few days later and may not show all of the symptoms mentioned above. Furthermore, mild cases are not likely to be temporarily sterilized.

Before mentioning treatment, I would like to enlarge a little on the blood changes which account for many of the symptoms. The effect of heavy doses of ionizing radiation is largely on the bone marrow, lymph glands and spleen. In other words, the damaging effect is on the blood-forming organs. This damage is reflected

TABLE I.

| | *Develops about* |
|---|---|
| Weakness | 8th day |
| Malaise | 8th " |
| Loss of appetite | 10th " |
| Diarrhœa | 10th " |
| Bloody diarrhœa | 13th " |
| Loss of hair | 13th " |
| Abdominal cramps | 11th " |
| Pallor | 10th to 12th day |
| Shock | 13th day |
| Ulcerations in mouth | 10th " |
| Hæmorrhages | 10th " |
| Blood changes | 10th " |
| Fever | 10th " |
| General debility and rapid emaciation | 10th to 14th day |
| Dehydration | 13th day |
| Acidosis | 13th " |
| Lowered resistance to infection | 10th " |

in the blood changes which are related to the life span of the various cellular elements of the blood. It appears that cells which are already circulating in the blood are little affected by ionizing radiations. They will continue to live out their ordinary life span.

The lymphocytes are depressed first and drop quite low on the first day. Regeneration of lymphocytes ordinarily becomes noticeable on the third or fourth day after exposure. Granulocytes are depressed rapidly but more slowly than the lymphocytes. There is little change in the granulocytes on the first day but it becomes quite marked by the fourth or fifth day. Quite commonly by the 10th day, granulocytes have almost completely disappeared from the blood. At the 10th day, the white blood cells consist almost entirely of lymphocytes, monocytes and relatively large numbers of plasma cells. Platelets also become decreased in numbers, receiving their greatest depression between the 10th and 16th days.

The red blood cells, having a much longer life span, probably exceeding 100 days, show very little depression until after the second week. Anæmia becomes progressively worse during the third to sixth weeks, the modifying factor being the amount of regeneration going on in the bone marrow.

Along with the depression in platelets there is a very significant increase in heparin circulating in the blood. The increased amount of heparin and depression of platelets no doubt accounts for the prolonged coagulation time, prolonged bleeding time, and severe hæmorrhages encountered in radiation sickness. The disappearance of granulocytes from the circulation corresponds to the appearance of infections, ulcerations in the mouth and general debility. These symptoms are very like Vincent's angina seen in agranulocytosis. Hæmoconcentration may occur in association with dehydration and acidosis which are likely to be associated with the intense diarrhœa.

## TREATMENT

Treatment must be directed toward combating the effects of radiation sickness. Very little can be done of a specific nature but much can be done to improve the well-being of the patient if the factors causing the symptoms are kept in mind. Good laboratory work is absolutely necessary. The white cell count must be done daily. The patient must have the best possible nursing care, giving special attention to the skin and mouth, wounds, etc. The fluid balance should be maintained by giving adequate amounts of fluid by mouth or intravenously. Acidosis should be controlled by sodium chloride and soda bicarbonate by mouth or intravenously. The patient should be given a high protein diet as tolerated. The diet may have to be supplemented by the use of amino-acids and glucose.

Penicillin should be given in doses of from 200,000 to 1,000,000 units per day preferable by mouth. This is a prophylactic treatment in an attempt to control infections. Streptomycin should be given if the patient develops septicæmia or *B. coli* infection.

Liver extract or vitamin $B_{12}$ and folic acid should be given daily to bolster the formation of red blood cells. Leucocyte cream may be

given in an attempt to increase the ability of the patient to combat infections.

Blood transfusions of 500 c.c. per day should be given, starting early even before symptoms have appeared other than blood changes. Blood transfusions are probably the most valuable single procedure. They replace red blood cells which are disappearing and to a certain extent, provide normal white blood cells.

Toluidine should be given intravenously in sufficient dosage to bring the coagulation time of the blood nearly to normal limits. Toluidine neutralizes heparin thereby preventing its action. The doctor should be careful to maintain a slightly prolonged bleeding time in order to prevent thrombi forming in the small blood vessels which no doubt have a certain amount of primary radiation damage. Vitamin K is not indicated in radiation sickness since there is practically no depression in prothrombin.

No treatment is necessary for loss of hair. If the patient survives, the hair will start to grow in about three months. No treatment is of any value for temporary sterilization or menstrual disturbances. These conditions will be restored to normal in due time in most cases. Miscarriages occur at the time when hæmorrhages are the most prominent and are practically always due to separation of the placenta by hæmorrhage. Keloids develop rather frequently when a wound or burn heals. Nothing of value can be done for these cases. The cases who recover for the most part will recover completely. However, there will be some cases in which the bone marrow remains aplastic and these patients will eventually die of aplastic anæmia or complicating infections.

SUMMARY

Some of the problems presented if an atomic bomb should fall on a large modern city have been outlined, together with the special precautions which must be taken in organizing and carrying out rescue work.

The limitations to first aid treatment and emphasized special features of hospital care have been mentioned.

The signs and symptoms of radiation sickness and the methods and rationale of treatment have been outlined.

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## FAMILIAL MULTIPLE POLYPOID DISEASE OF THE COLON

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THIS title is lengthy, but according to Buie,[9] it is the most concise of the many, though hereditary polyposis of the colon seems still more concise. Polyps occur throughout the colon and rectum in various numbers and at all ages. The danger of this designation is that it throws together under one name several types of neoplasm, the potentialities of which differ (Moore[1]). As they are very often the site of origin of early malignant changes, whether in a multiple state or in one of singleness, their early detection and prompt eradication is a matter of great importance.

*Classification.*—Erdman and Morris[2] in their survey provide the best classification for a working knowledge of this disease. The term "polyposis" is employed to describe a widespread adenomatous proliferation of the mucous membrane of the intestine, leading to the formation

of multiple papillary adenomata. The intestinal polyps of different histological structure, such as inflammatory or lipomatous or fibromatous polyps, should not be included as they show no particular tendency to malignant degeneration. According to MacKenny,[4] these are found in infants, children and youths and are no doubt sequelæ to bouts of colitis.

Two types are distinguished: (1) The familial variety which affects several members of one family and manifests itself usually in adolescence. (2) The acquired variety, usually later in life and does not appear to depend upon any hereditary factor.

The interesting feature of the familial type is that it always occurs in very widely disseminated fashion, extending from the ileocæcal junction down to and including the rectum. It occurs chiefly in the rectum and sigmoid as Helwig[5] (1943) in 1,460 autopsies pointed out.

Although both types possess a tendency to malignant change, the liability to cancerous degeneration is extremely well marked in the familial type, but to a lesser degree in the case of the acquired variety. We will consider only the familial type in this review.

*Incidence.* — Familial polyposis is relatively rare, and according to Jones and Turnbull[14] (1948) Hullsiek only found 127 cases recorded in the literature. Dukes[19] (1930) called attention to scattered reports appearing as early as 1721. There arose confusion, however, as to which were purely familial in character. In 1822, before the Pathological Society of London, Harrison Criggs (Jones-Turnbull[14]) first accurately described the condition with two proved cases. MacKenny[3] has followed the disease throughout three generations. Zahlmann,[18] observed a family in which the mother had two healthy children by her first husband, while four children by her second husband, who had polyposis, suffered from polyposis. Sex incidence is 3:2 in men.

*Morbid anatomy and histology.* — In the familial variety, as previously noted, the entire mucosal surface may be studded with innumerable tumours ranging in size from tiny mammillations, barely visible to the unaided eye, up to large, pedunculated tumours. The smaller ones are sessile but the larger growths are often attached by a broad, strap-like stalk. As to numbers, there is considerable variations. They may cover the entire surface of the colon or they may be sparsely scattered throughout, but with great constancy there is always a large total number of polyps present with granular surfaces.

The confines of the disease are demarcated by the ileo-cæcal junction. They may rarely be found in the terminal ileum.

Microscopic sections reveal the polypi to be true papillary adenomata, the stalk of which is derived from submucosal fibrous tissue and the epithelial layer continuous with that of the bowel, and in the latter active epithelial proliferation is in progress (Jones-Turnbull[14]). The more peripheral part contains many glands lined by goblet cells or columnar cells with an acidophilic cytoplasm or combinations of both. The muscularis mucosa typically extends into the vascular connective tissue stalk as a continuous or uninterrupted layer. In fact, all stages in the formation of an adenoma may be found. Between the tumours mucosal hyperplasia can be demonstrated.

*Relation to carcinoma.* — Boyd[11] states that papillomata and adenomata of the rectum and/or of colon must be considered precancerous. Microscopical examination of all adenomatous polyps shows that about 10% are malignant, in that there are anaplastic cells and acini and invasion of the stalk. About 30% of all colons with carcinoma also have one or more polyps (Klemperer,[7] 1938; Swinton and Warren,[10] 1939). The structure of the papilloma is glandular and that of the malignancy is adeno-carcinomatous, therefore the line of demarcation is exceedingly sharp and definite. Usually only one papilloma is malignant, but others may show the changes. In a moderately advanced case there can be a number of areas which have undergone marked malignant degeneration.

Fitzgibbon,[15] has concluded that all carcinomata of the colon develop from polypi. Duke[8] suggests that a careful search be made for these changes. A feature suggestive of malignancy is a darker colour, passing to brown or black; a firm or hard consistency and the presence of ulceration. Most simple adenoma are rather pinkish and have a soft or even rubbery sensation to touch. The relation of the two conditions is especially well illustrated in hereditary polyposis and the usual fate is carcinoma begin-

ning in the third or fourth decade (Lockhart-Mummery and Dukes;[6] Lahey[17]).

*Inheritance.* — That the members of some families show a definite proclivity to develop malignancy in certain organs is all too well demonstrated in almost any community. MacKenny[4] states that papillomatosis of the colon is not only markedly hereditary but his series ably demonstrates that it can be transmitted by either sex as a Mendelian dominant, and is thus not sex-linked. The disease is not congenital in the ordinary sense of the word, as it does not manifest itself for several years.

Lockhart-Mummery and Dukes[6] review in 1937 suggests that familial adenomatosis is the result of inherited instability of the epithelial cells of the large bowel which renders their nuclei peculiarly liable to undergo mutation for an excessive rate of growth. They regard the increased incidence of cancer of the colon and rectum as a secondary phenomenon dependent upon the fact that mitotic division is more frequent in proliferating adenomata than in normal mucosa. Lockhart-Mummery's cases show that these families tend to die out.

At any rate, as each succeeding generation appears and the seemingly predestined members assume their tragic rôles, the younger age incidence rather dramatically points to an early extinction of this unfortunate family. Each generation appears to develop the symptoms at an earlier age and the members seem to succumb in a shorter space of time (see Table I). As the adenomatous polyps are true neoplasms and not pseudo-polyps, formed of redundant and isolated mucosa in inflammation and ulceration of chronic ulcerative colitis, the presence of mild inflammation in the polyp may as well be effect as cause.

*Symptoms and diagnosis.*—The onset of this condition is usually insidious and often it will proceed unheralded by unusual symptoms. The history will usually provide an interval of early symptoms which are sketchy and meagre, with reference only to a slight and undisturbing looseness of bowel habit, probably related to motility and secretion. There may soon be crampy pains noted and later the passage of mucus and then blood will accompany the stool. The later symptoms are an exaggeration of these signs and there is accompanying secondary anæmia, with a feeling of lassitude, but no temperature or pulse rate increase.

Admittedly these are the symptoms of a host of other maladies, *e.g.,* carcinoma, chronic ulcerative proctocolitis, diverticulitis and endometriosis of the intestinal wall. If one obtains a familial history of this type of disease there will be little doubt in the mind as to the immediate gravity of the situation. The condition may vary in intensity, and in two of Duke's[8] cases there had been moderate symptoms for seven years before consulting a physician.

The history, of course, is important. The investigation by proctoscope and sigmoidoscope is extremely valuable, as is any corroboratory x-ray evidence. The gloved finger, carefully employed, will often delineate the ominous rectal masses.

*Treatment.* — This aspect poses a difficult problem. The comparative youth of the victims of this disease presents a tremendous factor in assaying and weighing the evidence at hand and selecting an appropriate course of treatment. Radical and early extirpation of colon and rectum is thought, by many, to be the only course which has a lasting effect on the ravishes of this disease. Sadly enough, to be completely effective or protective, it should even precede the malignant changes.

Such a procedure is a formidable one. One must realize the resultant chaos in the normal physiology, such as the fluid recovery and electrolyte absorption which under normal circumstances takes place so freely in the colon. The ascending and right half of the transverse colon are supplied by the superior mesenteric circulation and are embryologically the midgut, and, therefore, chiefly absorptive in function.

Watt and Goldenberg[13] (1948) report male twins, children of a father who died of "cancer of the bowel". Each of these men died in their 26th year of carcinomatous changes in polyposis of the colon with widespread metastasis. One had had previous negative biopsy reports, but finally a positive malignancy biopsy was obtained. He was dead within months. His brother was diagnosed as early rectal carcinoma with polyposis and was, therefore, discharged from the army in 1942 without treatment. His symptoms only became acute in 1946 and he died in 1947, as did his twin,

only a few months apart. Surely this type of evidence is a solid argument for early and complete colectomy in these cases!

Just as Dr. F. H. Lahey[12] makes a plea for early ileostomy in ulcerative colitis, so also could the plea be entered here as being indubitably justifiable. Acceptance of the dread permanent ileostomy by the patient must rest primarily upon medical indications but this acceptance must also be based upon adequate assurance that the ileostomy may be borne without undue discomfort or without marked interference with the daily activities of the patient. The development of the Koenig-Rutgen bag and its effectiveness in maintaining a watertight seal about the ileostomy stoma make it possible for the physician to give the patient this assurance with sincerity and conviction.

In some cases it is possible to perform colectomy and anastomose the distal ileum with the highest point of the pelvic colon. The remaining tumours in the rectum and pelvic colon are fulgurated. This type of procedure is subscribed to by Jones and Turnbull.[14] By careful and regular proctoscopic and sigmoidoscopic examination for years the patient is fairly well guaranteed a normal bowel habit with a very fair degree of safety from recurrence. Bacon[16] limits this procedure only to where the disease is sparse and confined to the rectum and lower sigmoid. This appears satisfactory to a degree, but the real argument against this procedure is that the most cancer-susceptible portion of the bowel is being left behind. There is no guarantee that new ones will not form.

Appendicostomy, ileostomy, cæcostomy, and colostomy are the non-radical palliative measures. They are of value only in putting the bowel at rest, preliminary to more extensive surgery.

Irradiation, usually palliative, appears to give some degree of improvement. In some, the polypi disappear entirely, in many they are greatly reduced in size and number. Often there is produced a tubular condition of the bowel, the lumen diminishes and the wall thickened. These patients have much less signs and symptoms as far as their immediate health is concerned. As to the future, claims are never made.

## CASE REPORT

C.F., a 40-year old male, in June, 1948, presented himself to one of us with a vague history of infrequent and brief bouts of diarrhœa. These had occurred during the past year. There recently had been blood, mucus and cramps accompanying the stool passage.

His general nutrition was good. His general physical examination revealed nothing abnormal until the digital investigation of the rectum delineated a number of polypi.

His work would not easily permit his hospitalization until August at which time he was admitted to the Victoria General Hospital, Halifax. Sigmoidoscopic

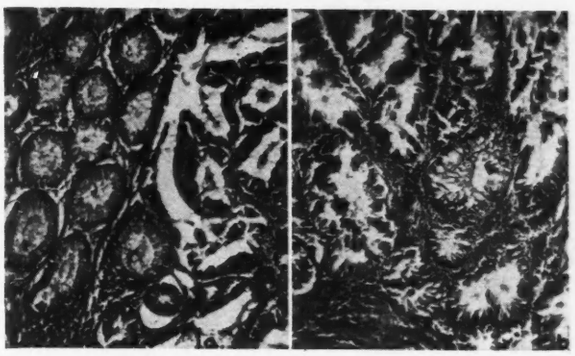


**Fig. 1.**—(a) This demonstrates the regular pattern of the normal mucosa on the left and the abruptness of the change to the malignant infiltration as seen on the right of the figure. (b) Observe the malignant process infiltrating the fibrous stroma which constitutes the base of one of the papilloma. Note the marked cellularity, deep staining nuclei and many mitotic figures in this cut.

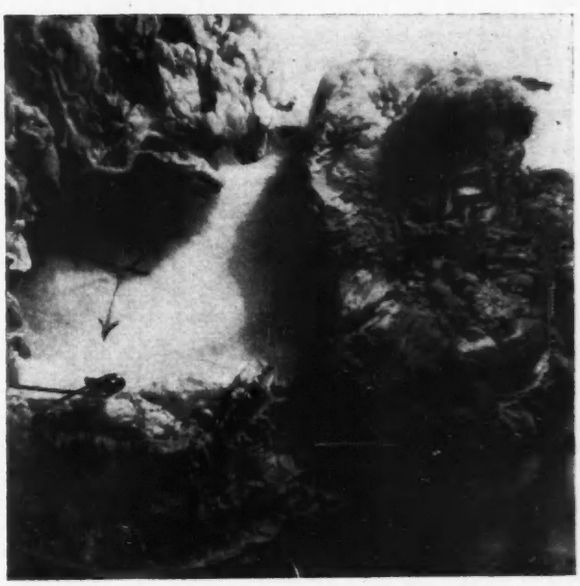
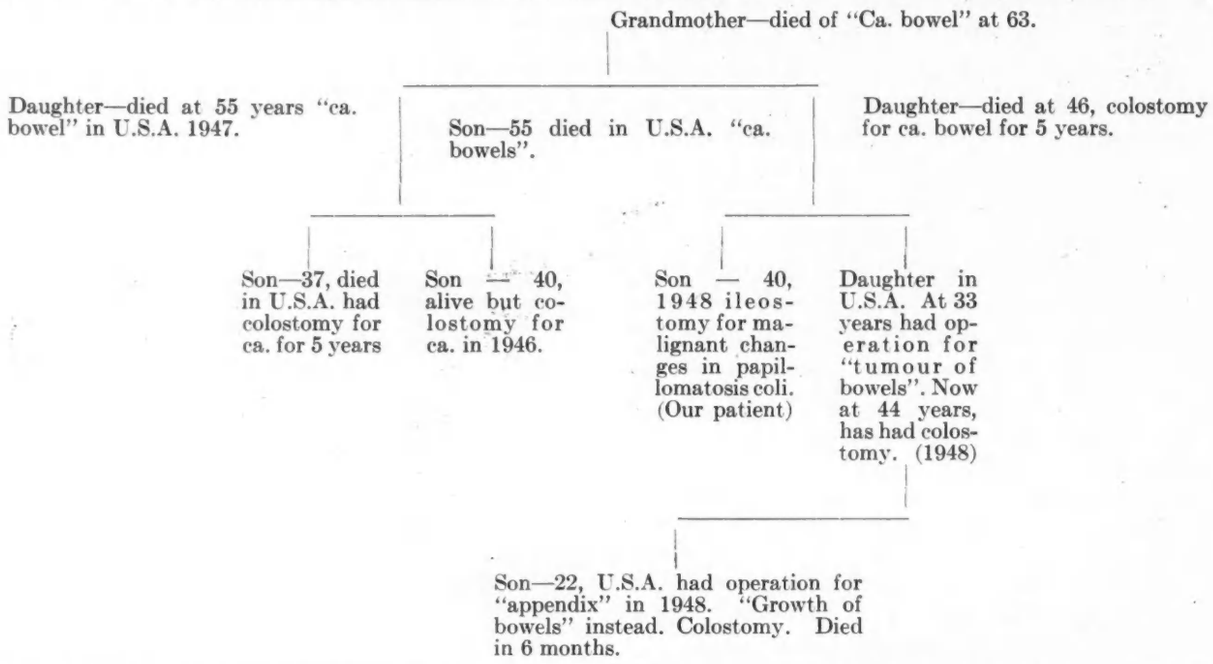


**Fig. 2.**—As in the text, note the marked formation of papillomata. Some are small, some pedunculated, many large and irregular. This obtained from cæcum to rectum.

examination revealed multiple polypi of which a representative number were biopsied. These were negative. The gravity of the situation was explained and he asked a month to put his affairs in order before returning for colectomy. He returned in late September and had a colectomy performed in October by Dr. N. H. Gosse. In the gross, the large gut revealed multiple polypi ranging in magnitude from pin head to marble size. Many were sessile, most were pedunculated. A remarkable colour

TABLE I.


Grandmother—died of "Ca. bowel" at 63.
Daughter—died at 55 years "ca. bowel" in U.S.A. 1947.
Son—55 died in U.S.A. "ca. bowels".
Daughter—died at 46, colostomy for ca. bowel for 5 years.
Son—37, died in U.S.A. had colostomy for ca. for 5 years
Son — 40, alive but colostomy for ca. in 1946.
Son — 40, 1948 ileostomy for malignant changes in papillomatosis coli. (Our patient)
Daughter in U.S.A. At 33 years had operation for "tumour of bowels". Now at 44 years, has had colostomy. (1948)
Son—22, U.S.A. had operation for "appendix" in 1948. "Growth of bowels" instead. Colostomy. Died in 6 months.

distribution was manifestly apparent. In the ascending colon the tumours were pink, gradually changing over the course of the transverse and descending colon to a bluish, then to a violet and finally to a black appearance in the pelvic colon (Fig. 2).

The microscopic picture was one of adenocarcinomatous changes and these were marked in the pelvic colon (Fig. 1).

The dramatic family history of this case, early elicited, is best presented in tabular form.

This man has 5 children, all under 10 years of age, who will be investigated at regular intervals and who will be a source of great interest to follow up.

## SUMMARY

1. A case of familial multiple polypoid diseases of the colon is presented.

2. A dramatic familial history is noted.

3. Comparative abruptness of the onset of malignant changes is observed.

4. Early and complete extirpation of colon and rectum is the method of choice in this disease. Some authorities submit that in certain cases, colectomy with anastomosis of ileum and pelvic colon, and subsequent fulguration of polyps in rectum and sigmoid is advisable.

We wish to express our thanks to Dr. N. H. Gosse for permission to publish this case.

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Biology seeks the analysis of living nature. When we pass beyond this analysis to nature dead, that is, when we reduce the activities of living organisms to physical and mathematical terms, we have ceased to talk biology. Even if, ultimately, we do succeed in expressing the activities of the brain in terms of biochemistry and biophysics, we shall still not have achieved a comprehensive insight into the brain as an organ. We shall merely have elaborated a fresh field of discourse about its ingredients, and it will not be a biological discourse. —F. M. R. Walshe.

# SOME BIOCHEMICAL STUDIES OF HEPATITIS WITH SPECIAL REFERENCE TO THE PROBLEM OF DIFFERENTIATING MEDICAL AND SURGICAL JAUNDICE*

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IN discussing the differentiation of medical and surgical jaundice I hope that the emphasis I shall give to biochemical aspects will not convey the impression that the history and physical examination have in any way become subjugated. They provide the diagnosis, unaided, in from 60 to 70% of cases of jaundice, the best the laboratory can do being to improve this efficiency to about 85 or possibly 90%. In developing the theme which I have indicated I will devote some time, first of all, to fundamental concepts of jaundice. For a number of years, now, we have found considerable satisfaction in the classification of jaundice which was proposed by Arnold Rich.[1] This is a basic classification which as, I shall attempt to show, requires further subdivision from the standpoint of medical and surgical jaundice. Rich divided jaundice into two groups, *retention* and *regurgitation*, the former characterized by a delayed or indirect van den Bergh reaction and by the absence of bilirubinuria; the latter by a prompt direct van den Bergh reaction and bilirubin in the urine. There are many reasons for believing that this difference is due to the character of the bilirubin complex present in the blood in the two forms. Evidence has been discussed elsewhere[2] which indicates that the excessive serum bilirubin in retention jaundice is a bilirubin which the liver has not yet excreted into the bile, and which is still firmly attached to protein, quite conceivably the original globin of the parent hæmoglobin molecule. The term bilirubinglobin, first employed by Duesberg,[3] is at least tentatively justified on theoretical and experimental grounds.[2-4, 5] In crossing the barrier between sinusoids and bile capillaries, a barrier composed of the v. Kupffer or retieuloendothelial cells, and the polygonal, or liver cord cells, the bilirubin is separated from its protein and becomes the simpler sodium salt,[6] sodium being the preponderant cation of the bile and combining very readily with the carboxyl groups of bilirubin. It is this compound, in all probability, which regains access to the blood in regurgitation jaundice. A number of studies have indicated that the pathway of this regurgitation is mainly via the thoracic duct lymph, at least in the earlier stages of the disturbance.[7, 8, 9] Sodium bilirubinate is characterized by a prompt direct van den Bergh reaction and it is probably the form in which bilirubin is excreted in the urine in regurgitation jaundice. Bilirubinglobin, on the other hand exhibits a delayed van den Bergh reaction[4] and is not excreted in the urine even at high levels in the serum.[2]

All human serums, both normal and pathological, contain these two forms of bilirubin in varying proportion. Thus, as one might expect, the reaction curve of any serum exhibits a fast or steep, and a slow or gradual component.[2] The shoulder of this curve, corresponding with the end of the prompt reaction due to sodium bilirubinate, and with the beginning of the delayed reaction of bilirubinglobin, occurs at about one minute after mixing the serum and diazo reagent. This is quite in accord with van den Bergh and Snapper's observations[10] that the prompt direct reaction took place largely within 30″, the delayed reaction only becoming evident within several minutes and consisting of a gradual deepening of colour. These observations, curiously enough, were given but little heed in the quantitative determinations of the van den Bergh reaction which have been described in more recent years. Thus it has been customary to determine the "direct" bilirubin at from 10 to 30′[11] a procedure which clearly includes a varying proportion of the delayed reacting type with the prompt, in other words of the bilirubinglobin with sodium bilirubinate. Although van den Bergh and Snapper clearly recognized the significance of the prompt reaction, within the first minute, they did not measure this fraction quantitatively, presumably because of the lack of a sufficiently sensitive method to detect the small amounts present in normal and in some pathological serums. The Malloy-Evelyn[11] modification of the van den Bergh method provided the great advantage of

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avoiding precipitation of the serum proteins, and thus of variable loss of bilirubin. This, however, measured the direct fraction at 30′. Ducci and I[12] modified this further by making the initial measurement at the critical time of 1′, after which alcohol is added to induce immediate reaction of the slow component (bilirubinglobin) and thus permit determination of the total.

As a result of a very satisfactory experience with this modification, it is my opinion now that much confusion might be avoided if but two terms were employed in discussing the fractional serum bilirubin determination. (1) The prompt (1′) and (2) the total. The difference equals the delayed or indirect reacting component. In our experience this fractionation has considerably enhanced the value of the serum bilirubin determination, principally because the normal amount of the prompt reacting fraction is so small, not in excess of 0.2 mgm. per 100 c.c., and usually less than 0.15.[2] The upper limit of normal for the total serum bilirubin probably does not exceed 1.0 mgm.[2] This value is established with more difficulty because of the occurrence of certain individuals, otherwise normal, with total serum bilirubin well above 1.0. These probably belong to the abnormal group known as constitutional hepatic dysfunction, or familial nonhæmolytic icterus, to which reference will be made again in a moment.

In infectious hepatitis it is of considerable interest and practical significance that during the pre-icteric or prodromal stage, the prompt reacting serum bilirubin is often increased to from 2 to 3 times the upper limit of normal, without elevation of the total bilirubin.[2, 13] This may be the prelude to a rapid increase of both prompt and total, with appearance of jaundice, or the disease may abate without further elevation (hepatitis without jaundice). Another point of much practical importance in this regard, is the occurrence of bilirubin in the urine under the same circumstances.[2, 13, 14] Studies of bilirubinuria in early hepatitis have clearly shown the fallacy of the concept that there is a fixed renal threshold of 2 mgm. (total) bilirubin.[2, 13] Actually it is impossible to fix any threshold but it appears certain that the presence of bilirubin in the urine is correlated with increases of prompt reacting rather than total serum bilirubin. A number of instances of relatively pure retention jaundice have now been studied, with total serum bilirubin of 10 to 15 mgm. per 100 c.c., chiefly of the delayed or indirect type, but without bilirubin in the urine.[2] On the other hand some cases of incipient hepatitis exhibit bilirubinuria with a total serum bilirubin less than 1.0 mgm., of which the prompt fraction is from 0.4 to 0.6 mgm.[13]

In employing Rich's basic classification of jaundice as already mentioned, it should be emphasized that the terms retention and regurgitation are used in the following in a relative, rather than an absolute sense. Thus, while there are cases of pure retention jaundice, most instances thus classified have a minor element of regurgitation as well, in the sense that the prompt or 1′ bilirubin is slightly elevated. Conversely, all cases of regurgitation jaundice have some element of retention, since the prompt bilirubin comprises but 40 to 80% of the total, the remainder representing retention. In our experience the prompt bilirubin is usually greater than 50% of the total even in those cases of regurgitation jaundice which are clearly due to a diffuse parenchymal disease of the liver, rather than a simple mechanical obstruction. This should be clearly appreciated because the fallacious idea has often been held that the presence of bilirubinuria with a prompt direct van den Bergh reaction, is diagnostic of biliary obstruction and indicates surgical interference.

One might well expect that the prompt reacting bilirubin would comprise a greater percentage of the total in cases with relatively good hepatocellular function, and that there might be some value, in terms of percentage of the total, which would be critical insofar as differentiation of medical and surgical jaundice is concerned. It is true that there are many cases of parenchymal jaundice with less than 50% of the prompt reacting type but there are also many with considerably more than this, at various levels of jaundice; and, conversely, there are some cases of mechanical obstructive or surgical jaundice, exhibiting somewhat less than 50% of 1′ or prompt bilirubin. Thus, the fractional serum bilirubin is not very helpful in the distinction, but if the prompt reacting fraction is less than 50% of the total, the likelihood of medical rather than surgical jaundice is considerably increased. It appears that the conversion of the delayed to the prompt react-

ing bilirubin is easily maintained even by a severely damaged liver. In cases of subacute atrophy or advanced cirrhosis, with well marked hepatic insufficiency, it is not unusual to note high levels of serum bilirubin, 60 to 70% of which may be the prompt type. In the same cases one may note considerable elevation of blood urea nitrogen indicating that deaminization is still progressing in some measure. Thus it is evident that even though the liver may appear entirely abnormal or destroyed, microscopically, certain of its metabolic enzymes are still active.

With these points in mind one may now consider the following subdivisions of Rich's classification, with respect to the question of medical or surgical treatment.

MEDICAL

*Retention jaundice.*—Hepatocellular inability to remove bilirubinglobin from the blood. Hæmolytic jaundice—overloading. Constitutional hepatic dysfunction—inherent sluggishness. Mild hepatocellular injury, either chemical, infectious or anoxic in origin—acquired and transitory.

*Regurgitation jaundice.*—Cholangiolar leakage of bile to lymph and thence to blood. Infectious hepatitis. Moderate or severe hepatic injury, either chemical, infectious, dietary, or anoxic in origin. Hepatic cirrhosis secondary to or associated with any of above. Hepatic carcinomatosis, Hodgkins disease or lymphoblastoma.

SURGICAL

Extrahepatic biliary obstruction due to: cancer; calculus; stricture, and with or without a secondary obstructive, biliary cirrhosis.

The cholangiolar leakage just referred to is believed due to one or both of two factors: (1) rhexis or rupture secondary to increased intrabiliary pressure, (2) leakage or "diapedesis" of bile due to increased permeability. The available evidence[15] indicates that the ampullary termination of the bile capillaries may be the "Achilles' heel"[16] insofar as these changes and the resultant regurgitation of bile is concerned.

In the distinction of medical and surgical jaundice, the fractional serum bilirubin and the urine bilirubin quickly permit a screening of all cases of retention jaundice. These are not treated surgically except for splenectomy in hæmolytic jaundice which is easily recognized by appropriate studies of the red cells and bone marrow, and the fæces urobilinogen. These studies also permit a sharp distinction of constitutional hepatic dysfunction,[17] in which splenectomy is clearly undesirable.

It is well to recall that regurgitation jaundice may become superimposed upon retention jaundice. The most characteristic example is the case of hæmolytic jaundice developing calcium bilirubinate gall stones due to heightened blood destruction, these in turn causing hindrance to the outflow of bile because one or more of the stones obstructs the common duct. In severer "crises" of the disease, transitory regurgitation jaundice at times appears to be due to intrahepatic cholangiolar injury, rather than any extrahepatic obstructive factor.

At this point it will perhaps be well to refer briefly to the two simple tests which are the only ones available for bedside use in studying cases of jaundice and liver disease, *i.e.*, the barium strip test for bilirubin in the urine, and the urine Ehrlich test for urobilinogen. The former was devised in 1945,[18, 19] with particular relation to the early recognition of infectious hepatitis in epidemics or in populations having a high endemic level of the disease. Obviously the test is not specific for hepatitis, but under these circumstances, and considered with other features, it offers valuable aid. The same may be said of the urine Ehrlich test. As a bedside method the intensity of colour in the Ehrlich aldehyde test may simply be gauged by the eye on a 1 to 4 plus basis. This is entirely subject to the personal equation, but is reasonably satisfactory for an individual examiner who develops his or her own standards of grading over a period of time. The colour intensity of the Ehrlich reaction may be measured quite accurately, either in a photoelectric colorimeter or by means of a comparator block in which a stable (pontacyl) dye standard is employed which has the same colour as the urobilinogen aldehyde compound.[20, 21] Since this method is not specific for urobilinogen, the result is recorded in terms of Ehrlich units, rather than mgm. of urobilinogen. Nevertheless urobilinogen is the chief contributor to the Ehrlich reaction in most urines, hence the colour intensity is usually roughly proportional to the urobilinogen content. These two simple procedures complement one another and in many instances provide guiding information with respect to the type of jaundice and to further studies which may be needed. The following rough index will convey some idea of their utility:

| | *Urine Ehrlich* | *Urine bilirubin* | *Conditions more likely present* |
|---|---|---|---|
| 1. | 0 | ++++ | Regurgitation jaundice; may be either medical or surgical. Little or no bile entering intestine. |
| 2. | ++++ | 0 | Retention jaundice or liver disease without jaundice. Often noted in hæmolytic jaundice; also in hepatic cirrhosis. |
| 3. | ++++ | ++++ | Regurgitation jaundice, more likely medical, either hepatitis or cirrhosis. |

The findings with these two tests in any given case of jaundice, may be quite indecisive, but in many instances they may serve to confirm the diagnosis suggested by the history and physical examination. For example if an elderly patient with painless jaundice is found to have a palpable mass suggestive of a distended gall bladder, and if the urine contains plentiful bilirubin and no demonstrable urobilinogen, the likelihood is strong of a cancer of the pancreas or biliary tract, requiring an attempt at surgical treatment. If, on the other hand, a patient with the same degree of jaundice is found to have spider nevi and fœtor hepaticus,[17] together with plentiful bilirubin *and* urobilinogen in the urine, one may safely conclude that the jaundice is medical, the combination mentioned being observed most frequently in cases of hepatic cirrhosis.

If facilities are available for the quantitative determination of per diem excretion of urobilinogen[22] more exact information may often be obtained, of considerable aid in distinguishing the various forms of jaundice. This has been discussed in detail elsewhere, and because of the limitation of time I will do nothing more than attempt to summarize our experience, as follows:

One who studies the manifold functions of the liver, as altered in various disease states, cannot fail to be impressed by the remarkable variations from case to case, in any given type of disease, as for example hepatitis or cirrhosis. This has emphasized more and more the fallibility of employing but one or two tests in cases that are at all borderline on the basis of history and physical examination, and the necessity of making a broad or composite study of liver function, if one is to detect milder cases of liver disease, and especially if one is striving for maximum efficiency, in distinguishing medical and surgical jaundice. We have had considerable satisfaction in recent years, in employing three groups of procedures designated as liver function schedules Nos. 1, 2 and 3.[13]

These are printed on gummed squares of paper, suitable for inclusion in the patient's chart. The upper or lower limit of normal for each test, as the case may be, is represented by a common horizontal line, the results in any given case being entered at the appropriate level by means of a short line traversing the column for each test. Thus one obtains what may be referred to as a profile of liver function, or an "hepatogram". The first of these, used for the *non*-jaundiced patient, includes the fractional serum bilirubin, the barium strip or modified Harrison test for bilirubin in the urine; the cephalin cholesterol flocculation test of Hanger and the thymol turbidity test of MacLagan, both of which depend on qualitative abnormalities of the serum proteins; the bromsulfthalein retention at 45′ after injection of 5 mgm. of dye per kilo of body weight; the urine Ehrlich test in units per 2 hour (2 to 4 p.m.) sample on two days, and if this be normal or borderline the 24 hour urine urobilinogen in

UROBILINOGEN EXCRETION

| *Type of jaundice* | *Fæces* | *Urine* |
|---|---|---|
| *Retention* | | |
| Hæmolytic jaundice | Markedly increased | Normal to greatly increased |
| Constitutional hepatic dysfunction | Normal | Normal or slightly increased |
| *Regurgitation* | | |
| Biliary tract cancer | <5 mgm. per day in 90% of cases | <0.3 mgm. in 90% of cases |
| Calculus | >5 mgm. per day in 90% of cases | Normal to greatly increased (with complications) |
| Parenchymal (hepatitis, cirrhosis, or other diffuse liver disease) | Majority of cases > 5 mgm. per day. Some have less for several days or weeks at height of disease | 0–300. mgm. depends largely on stage of disease. |
| | Fæces-urine ratio important | |
| | Ex. { 10 mgm. ..... 5.0 mgm. | |
| | { 600 mgm. ..... 150.0 mgm. | |

mgm.; and finally, the 24 hour urinary coproporphyrin in micrograms. This schedule has proved very useful in screening clinical material with respect to liver disease or functional impairment of the liver, in the absence of recognizable jaundice. Schedule No. 2, for use in the jaundiced subject, differs from No. 1, in omitting the bromsulfthalein test, and adding the fæces Ehrlich in units per 100 gm., also the total serum cholesterol and cholesterol esters, and the serum alkaline phosphatase in Bodansky units. A third or supplementary schedule includes the serum albumin and globulin in gm. per 100 c.c., the intravenous hippuric acid test (with a simultaneous phenosulphthalein test of renal function), and the prothrombin time together with response to vitamin K, if an initial hypoprothrombinæmia has been found.

Schedule No. 2, for the jaundiced subject, is the one which relates most significantly to the problem of distinguishing medical and surgical jaundice. This schedule, in the main, is believed to represent an investigation of the type of bile which is being formed. If the liver cells are functioning poorly, the bile which regains access to the blood in cases of regurgitation jaundice, as for example, in ordinary hepatitis, is likely to be relatively poor in such constituents as total cholesterol, alkaline phosphatase, and bile acids; hence, even in the presence of marked jaundice, these elements do not increase, whereas they are characteristically increased in cases of relatively pure cholangiolar injury, such as occurs with a mechanical biliary obstruction. The total cholesterol, alkaline phosphatase, bile acids, and albumin of the serum, especially the first three, tend to behave in the same fashion in regurgitation jaundice, as indicated in the following plan:

| | | |
|---|---|---|
| Increasing cholangiolar injury with relatively normal hepatocellular function (pruritus without ascites or œdema). | ↑ Total cholesterol<br>Alkaline phosphatase<br>Bile acids<br>— — — — — — — — —<br>↓ Albumin | Increasing hepatocellular functional impairment (Tendency to œdema or ascites formation; pruritus not a feature). |

The concentration of the first three of the above may increase to values several times the normal; in the case of the albumin however, the arrow on the left simply represents a relatively high or normal level.

The bile acid determination is not included in the liver function schedules just alluded to, because, unfortunately, there is no available technique for routine usage. In general, however, it may be assumed that if a patient with regurgitation jaundice displays pruritus, the bile acids in the serum will be found significantly elevated. This is not to say that bile acids or salts are necessarily the direct cause of pruritus, although there are a number of reasons for believing in a fundamental relationship.

If the total cholesterol and alkaline phosphatase are normal or reduced in a case of regurgitation jaundice, one is probably warranted in the assumption of a diffuse hepatocellular injury, and hence, more likely, a medical cause of jaundice. Unfortunately, the converse is by no means as definite, since in the so-called "cholangiolitic" hepatitis or cirrhosis, hepatocellular function is relatively good, and marked elevations of these substances are characteristic. In fact the increases are often so marked that the possibility of over-production (by the cholangiolar epithelium?) must be considered. In any event the elevated values serve to promote confusion between this type of medical jaundice, and the various forms of surgical jaundice. One may even question whether it ought not be classified as surgical, since Varco[23] has shown that some of these cases obtain signal relief from intractable pruritus if a T-tube is placed in the common duct and part of the bile drained to the outside. The relief may be due to interruption of the enterohepatic circulation of bile salts. It is fortunate that these cases, because of their relatively good hepatocellular function, appear to tolerate operation much better than the ordinary cases having more impairment of function. Nevertheless, it is highly desirable to recognize the condition *before*, rather than during or after operation, in order that all preparations may be made, should common duct intubation be elected because of pruritus. Needless to say, this should not be attempted until all conservative means of treatment have failed. The difficulty of recognizing these cases preoperatively may be insurmountable without benefit of peritoneoscopy and/or liver biopsy. The method of Royer,[24] *i.e.*, cholangiography under peritoneoscopic control, ought to be helpful in such cases, but in our hands it has not proved practical. In doubtful cases of this type, a small

incision under local anæsthesia, for purposes of liver biopsy and cholangiography (through the gall bladder) has proved highly advantageous and uncompromising to the patient's welfare.

It must be emphasized that the total cholesterol may be considerably increased with a *reduced* percentage of esters. This combination is often seen in cases of cancer of the pancreas or bile ducts, with jaundice; somewhat less frequently in hepatitis or cirrhosis. The cholesterol ester percentage in our experience is of relatively little help in the distinction of medical and surgical jaundice. We are convinced, however, that whatever the underlying disease, a progressive diminution of cholesterol esters clearly indicates deterioration of liver function and a worsening prognosis. The same is true of a falling alkaline phosphatase in the face of persistent or increasing jaundice.

The combination of reduced total cholesterol and elevated phosphatase is at times observed in cases of liver disease, in our experience being more suggestive of hepatic carcinomatosis or Hodgkin's disease. The Hanger cephalin flocculation and the MacLagan thymol turbidity tests for qualitatively abnormal serum proteins are very helpful in distinguishing medical and surgical jaundice, especially when carried out together. In a recent survey[27] in this laboratory of 77 cases proved to have either stone, stricture, or extra-hepatic cancer as the cause of jaundice, but one had both Hanger and MacLagan tests positive. The thymol turbidity test is more often "falsely" positive in the group, due in all likelihood to the enhancing effect of cholesterol and other lipids. In one case of cancer of the common bile duct with marked jaundice and a serum cholesterol of 720 mgm. per 100 c.c., the thymol turbidity was 60 units, the upper limit of normal being 4. The Hanger test was negative in this instance. A significant minority of the cases of parenchymal or medical jaundice, in the survey just alluded to, gave "false" negatives with both tests. This does not mean that they were actually unfaithful from a fundamental standpoint, but only that the results tended to be misleading in differential diagnosis, simply an evidence of the variability of liver functional impairment, such as I referred to before.

There is no condition which so clearly emphasizes the need and the difficulties of strict separation of medical and surgical jaundice, as homologous serum hepatitis. This is particularly true because the long incubation period, from the time of transfusion or needle puncture, is very likely to induce forgetfulness; furthermore the disease has occurred many times following transfusions or parenteral therapy incident to gall stone operations;[25, 26] in these cases the appearance of jaundice 3 months later may easily be ascribed to a common duct stone. It is in just such instances that the above mentioned schedule No. 2 is likely to help in avoiding what may well be a dangerous or even fatal operation. The experiences with hepatitis during the recent war and especially those with homologous serum jaundice in previously ill or weakened individuals, leave little doubt that a laparotomy will often place them in grave jeopardy. I am convinced that if the history and physical examination, and may I emphasize the adjective — the *supplementary* laboratory studies — have not clarified the issue, a liver biopsy either with a needle, or through a small incision under *local* anæsthesia, are much less jeopardizing than an exploration of the common duct under general anæsthesia.

I am sure, that in striving to emphasize certain biochemical aspects with which we have had relatively more experience I may well have done injustice to others with which we have had less or none at all. The study of liver function is indeed in a very dynamic period, what with the rapid improvement in recent years of methods of determining enzyme activity and studying cellular metabolism. It would not surprise me too greatly if in 5 or 10 years many of the tests comprising our present liver function schedules were to be supplanted by somewhat less empirical procedures relating in more specific fashion to one or the other of the integral groups of cells within the liver.

I wish, in closing, to acknowledge my gratitude to the officers and members of this College for the invitation to deliver this lecture, and for the gracious hospitality which has been extended to Mrs. Watson and me, during our visit to Ottawa.

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## INSANITY AS A LEGAL DEFENCE*

**Hon. J. C. McRuer, LL.D.**

*Chief Justice of the High Court of Ontario, Toronto, Ont.*

IT is with much hesitation that I have accepted your kind invitation to address this gathering, and I do so with a very keen consciousness that the problem you have asked me to discuss is one on which there may be a wide gulf between the medical and legal point of view.

There are certain basic presumptions in the administration of the criminal law that must be firmly borne in mind in considering its application to any subject. Every accused person is presumed to be sane, to know the law and to intend the natural consequences of his acts. Therefore, when the defence of insanity is set up, the onus is always on the accused to make out the defence by a preponderance of evidence, but not beyond a reasonable doubt.

It must be remembered also that insanity as a defence to a criminal charge must be considered in relation to all criminal offences. It is seldom, however, that the defence is raised on charges other than those involving homicide, and in my reading I find that it is seldom that this defence is discussed in relation to any other crime. One does not find anywhere emphasis placed on the fact that the verdict of the jury when the defence of insanity is made out in an English court, is "Guilty but insane", while in Canada it is "Not guilty on the ground of insanity". The same result flows. The accused is ultimately removed to an institution for treatment and that satisfies both legal and medical opinion as well as the public. All this indicates quite clearly that the important question in the minds of those who are interested in the subject is not whether one who is guilty of homicide ought to be convicted of a crime, but whether one who commits murder while suffering under any degree of insanity should be executed.

In every consideration of the plea of insanity as a defence in criminal cases one must go to the rules laid down by the English Judges in 1843, known as the rules in McNaghten's case. These form the foundation of our law.

One McNaghten, while labouring under a delusion that Sir Robert Peel had injured him, mistaking one Drummond for Sir Robert Peel, shot him dead with a pistol.*

"The medical evidence was that a person of otherwise sound mind might be affected with morbid delusions; that the prisoner was in that condition; that a person labouring under a morbid delusion might have a moral perception of right and wrong: but that, in the case of the prisoner, it was a delusion which carried him away beyond the power of his own control, and left him no such perception, and that he was not capable of exercising any control over the acts which had a connection with his delusion; that it was the nature of his disease to go on gradually until it reached a climax, when it burst forth with irresistible intensity; that a man might go on for years quietly, though at the same time under its influence, but would at once break out into the most extravagant and violent paroxysms." The questions left to the jury by Chief Justice Tindal were—"whether at the time the act in question was committed, the prisoner had or had not the use of his understanding so as to know that he was doing a wrong and wicked act, whether the prisoner was sensible, at the time he committed the act, that he violated both the laws of God and man".

The prisoner was acquitted and as a result of the discussion that followed in the House of Lords the Judges of the King's Bench were invited to answer certain questions, without debate. In delivering the opinions of the Judges, Chief Justice Tindal said: "They deemed it at once impracticable, and at the same time dangerous to the administration of justice if it were practicable, to attempt to make minute applications of the principles involved in the answers."

For convenience I set out the questions and answers in full:

"Q. 1. 'What is the law respecting alleged crimes committed by persons afflicted with insane delusion in respect of one or more particular subjects or persons;

* Address at Canadian Medical Association Annual Meeting, before the Section of Psychiatry, Toronto, June 25, 1948.

* Russ. Cri. 121.

as, for instance, where, at the time of the commission of the alleged crime, the accused knew he was acting contrary to law, but did the act complained of with a view, under the influence of insane delusion of redressing or revenging some supposed grievance or injury, or of producing some supposed public benefit?

"A. 1. 'Assuming that your lordships' inquiries are confined to those persons who labour under such partial delusions only, and are not in other respects insane, we are of opinion that notwithstanding the accused did the act complained of with a view, under the influence of insane delusion, of redressing or revenging some supposed grievance or injury, or of producing some public benefit, he is nevertheless punishable, according to the nature of the crime committed, if he knew at the time of committing such crime that he was acting contrary to law, by which expression we understand your lordships to mean the law of the land.

"Q. 2. 'What are the proper questions to be submitted to the jury where a person alleged to be afflicted with insane delusion respecting one or more particular subjects or persons, is charged with the commission of a crime (murder, for example), and insanity is set up as a defence?

"Q. 3. 'In what terms ought the question to be left to the jury as to the prisoner's state of mind, at the time when the act was committed?

"A. 2 and 3. 'As these two questions appear to us to be more conveniently answered together, we submit our opinion to be that the jury ought to be told in all cases that *every man is to be presumed to be sane, and to possess a sufficient degree of reason to be responsible for his crimes, until the contrary be proved to their satisfaction;* and that *to establish a defence on the ground of insanity it must be clearly proved that, at the time of committing the act, the accused was labouring under such a defect of reason, from disease of the mind, as not to know the nature and quality of the act he was doing, or, if he did know it, that he did not know he was doing what was wrong.* The mode of putting the latter part of the question to the jury on these occasions has generally been, whether the accused *at the time of doing the act knew the difference between right and wrong;* which mode, though rarely, if ever, leading to any mistake with the jury, is not, as we conceive, so accurate when put generally and in the abstract, as when put with reference to *the party's knowledge of right and wrong, in respect to the very act with which he is charged.* If the question were to be put as to the knowledge of the accused solely and exclusively with reference to the law of the land, it might tend to confound the jury, by inducing them to believe that an actual knowledge of the law of the land was essential in order to lead to a conviction: whereas, the law is administered upon the principle that every one must be taken conclusively to know it, without proof that he does know it. *If the accused was conscious that the act was one that he ought not to do, and if the act was at the same time contrary to the law of the land, he is punishable:* and the usual course, therefore, has been to leave the question to the jury, whether the accused had a sufficient degree of reason to know that he was doing an act that was wrong; and this course we think is correct, accompanied with such observations and explanations as the circumstances of each particular case may require.

"Q. 4. 'If a person under an insane delusion as to existing facts commits an offence in consequence thereof, is he thereby excused?

"A. 4. 'The answer must, of course, depend on the nature of the delusion; but making the same assumption as we did before, namely, that he labours under such partial delusion only, and is not in other respects insane, we think he must be considered in the same situation as to responsibility as if the facts with respect to which the delusion exists were real. For example, if, under the influence of his delusion, he supposes another man to be in the act of attempting to take away his life, and he kills that man, as he supposes, in self-defence, he would be exempt from punishment. If his delusion was that the deceased had inflicted a serious injury to his character and fortune, and he killed him in revenge for such supposed injury, he would be liable to punishment.

"Q. 5. 'Can a medical man, conversant with the disease of insanity, who never saw the prisoner previously to the trial, but who was present during the whole trial, and the examination of the witnesses, be asked his opinion as to the state of the prisoner's mind at the time of the commission of the alleged crime, or his opinion whether the prisoner was conscious at the time of doing the act that he was acting contrary to law, or whether he was labouring under any, and what, delusion at the time?

"A. 5. 'We think the medical man, under the circumstances supposed, cannot, in strictness, be asked his opinion in the terms above stated, because each of those questions involves the determination of the truth of the facts deposed to, which it is for the jury to decide, and the questions are not questions upon a mere matter of science, in which case such evidence is admissible. But where the facts are admitted, or not disputed, and the question becomes substantially one of science only, it may be convenient to allow the question to be put in that general form, though the same cannot be insisted on as a matter of right.'"

While these answers were opinions given in response to the invitation of the House of Lords and had not the authority of legal decision, they have since been given that authority by legal decision. In Canada the law has been codified in language that substantially expresses the judicial interpretation and application of these rules. Section 19 of the Canadian Criminal Code reads as follows:

"1. No person shall be convicted of an offence by reason of an act done or omitted by him when labouring under natural imbecility, or disease of the mind, to such an extent as to render him incapable of appreciating the nature and quality of the act or omission, and of knowing that such an act or omission was wrong.

2. A person labouring under specific delusions, but in other respects sane, shall not be acquitted on the ground of insanity, under the provisions hereinafter contained, unless the delusions caused him to believe in the existence of some state of things which, if it existed, would justify or excuse his act or omission.

3. Every one shall be presumed to be sane at the time of doing or omitting to do any act until the contrary is proved."

Before considering the application of this section in its broader aspects it may be appropriate to say a word in reference to subsection (2) dealing with delusions. It is of utmost importance to observe the precise words of this subsection and I emphasize the importance of every word of the opening clause and particularly the words, "A person labouring under *specific* delusions, but *in other respects sane*". In cases coming under this subsection the defence of insanity will not avail unless it be proved that the delusion was such as would justify the accused in doing the act which is the subject of the charge, if the facts believed to exist in fact existed. If, for example, the accused laboured under a delusion that he was the Prime Min-

ister of Canada, it would not be a defence to a charge of murder arising out of the killing of the leader of the Opposition, but on the other hand it would be a good defence to a charge arising out of the signing of the name of the Prime Minister to a cheque. At first blush this may appear to a medical mind to be a very legalistic doctrine but you will not overlook my purpose in emphasizing the precision of the language used by the draftsmen of this subsection. It refers to "specific delusions" and only to cases where the accused is "in other respects sane". Whether there are any cases where persons have committed crime while labouring under specific delusions and have been otherwise sane, I leave to the members of the medical profession. In practice, both in England and Canada, a delusion is usually treated as evidence of disease of the mind and the case is put to the jury not under subsection 2 but under subsection 1. Subsection 1 states the law in its broader aspects. Notwithstanding that the draftsmen departed from the McNaghten rules to make it read in the conjunctive instead of the disjunctive, the judicial interpretation has made it to conform to the McNaghten rules. The word "and" is interpreted as "or". Therefore, in Canada, the defence is made out if the accused is proved to be, by reason of mental disease or imbecility, incapable of appreciating the nature and quality of the act, *or* of knowing that it was wrong. Either will suffice.

The words "the nature and quality of the act" refer solely to its physical character and do not distinguish between the physical and moral aspects of the act. This matter comes under the second part of the subsection. In deciding whether the accused knew that the act or omission was wrong, the standard to be applied is whether, according to the ordinary standard adopted by reasonable men, the act was right or wrong.*

These are principles that are capable of reasonable application and during the last 105 years since they were laid down the debate that has raged has not been about the cases that come within them but those that lie without. The real difficulty arises where the accused is suffering from some mental disease but the requirements of the McNaghten rules as codified by the Canadian Criminal Code cannot be proved.

* *Rex v. Codere*, 12 Cr. App. R., 21 at p. 27.

There may be some who contend that no one suffering from any degree of mental disease should be held criminally responsible for his acts but with those contentions we are not seriously concerned. But there are many of great authority who believe that the McNaghten rules and our Code do not go far enough and that provision should be made to recognize that, "a person charged criminally with an offence is irresponsible for his act when the act is committed under an impulse which the prisoner was by mental disease in substance deprived of any power to resist". This is popularly, but somewhat inaccurately, referred to as the "doctrine of the irresistible impulse".

This is by no means a new suggestion. It was present in the minds of the Judges before the McNaghten case and was in some measure frequently applied in their charges to juries. It has been applied with some disregard of the law in several charges to juries since the McNaghten case. But a Judge's charge to the jury cannot be taken as a precedent having the force of law. Under the English law the Crown has no right of appeal and if a Judge misstates the law to the jury, resulting in an acquittal, his interpretation has no force as a legal precedent.

Sir James Stephen, a profound authority on criminal law, was convinced that it ought to be the law. In his *History of the Criminal Law of England*,* he states:

> "The proposition, then, which I have to maintain and explain is that, if it is not, it ought to be the law of England that no act is a crime if the person who does it is at the time when it is done prevented either by defective mental power or by any disease affecting his mind from controlling his own conduct, unless the absence of the power of control has been produced by his own default."

and, in *Reg. v. Davis*,† he said:

> "As I understand the law any disease which so disturbs the mind that you cannot think calmly and rationally of all the different reasons to which we refer in considering the rightness or wrongness of an action—any disease which so disturbs the mind that you cannot perform that duty with some moderate degree of calmness and reason, may be fairly said to prevent a man from knowing that what he did was wrong."

The same learned Judge in his *History of the Criminal Law of England*,‡ gives his definition of sanity in the following words:

> ". . . that sanity exists when the brain and the nervous system are in such a condition that the mental functions of feeling and knowing, emotion, and willing,

* Vol. II, page 168.
† 14 Cox's, C. C., 563 at page 564.
‡ Vol. II, page 130.

can be performed in their regular and usual manner. Insanity means a state in which one or more of the above-named mental functions is performed in an abnormal manner or not performed at all by reason of some disease of the brain or nervous system.''

Of these statements Dr. Stroud says in his work on Mens Rea (p. 82):

''To force such extended meanings into the famous Answers, and into the numerous judicial decisions defining the law of insanity, would be merely to rob words of their legitimate meaning.''

and referring to Dr. Oppenheimer's views expressed in his work on the Criminal Responsibility of Lunatics (1909) he says: ''The dictum of Stephen, J., in *R. v. Davis* is not good law, and his definition of sanity is not good sense''.

In 1920 in the case of *Rex v. Holt* the late Marshall Hall placed squarely before the Court of Appeal in England the duty of reconsidering the judicial interpretation of the McNaghten rules and in some measure extending them. In his opening remarks he said:

''I am going to ask your Lordships to consider in 1920 the whole question of insanity and the subject of mental diseases. It is time the question was now settled. I am going to show that, owing to a condition of mind which was partly due to heredity and partly to syphilis, the appellant killed Mrs. Breaks as the result of uncontrollable impulse.''

The Lord Chief Justice asked Mr. Hall, ''What is the proposition which you say is to be added to the McNaghten case or by which you say that case is to be modified?'' Mr. Hall's answer was:

''Will is different from reason. A man may know the difference between right and wrong and appreciate the nature and quality of his acts and the consequences thereof and yet be deprived of that instinctive choice between right and wrong which is characteristic of a sane person. Hitherto intellectual insanity, defective reason, has been the only insanity recognized by law but our contention is that a man's reason may be clear, even his judgment may be clear, yet his will power is absent or impaired or suspended so as to deprive the person affected of the power to control his actions or exercise his will power.''*

That was a clear statement for a modification of the law, but nevertheless the English Court of Appeal did not then, nor has it since, seen fit to alter it.

In 1922 the same matter came under review in the Court of Criminal Appeal in the case of *Rex v. Ronald True.*† The Court was then asked to adopt Sir James Stephen's statement of the law in *Reg. v. Davis.* It was contended that Lord Justice Greer had left the question of uncontrollable impulse to the jury in *Rex v. Holt,* to which I have already referred.* Lord Hewart, the Lord Chief Justice of England, in his judgment, with which Lord Justice Greer agreed, expressly excluded the doctrine of uncontrollable impulse from the English law.

Following this case, Lord Birkenhead appointed a committee consisting of Lord Justice Atkin, Sir Ernest Pollock, Sir Thimas Inskip, Sir E. Marshall-Hall, Sir Herbert Stephen, Sir Richard Muir, Sir Archibald Bodkin, Sir Edward Troup, and Sir Ernley Blackwell, to ''consider and report upon what changes, if any, were desirable in the existing law, practice, and procedure relating to criminal trials in which the plea of insanity as a defence is raised, and whether any and, if so, what changes should be made in the existing law and practice in respect of cases falling within the provisions of sect. 2, sub-sect. 4, of the Criminal Lunatics Act 1884''.†

The committee reported that the McNaghten rules should be maintained with the addition that ''It should be recognized that a person charged criminally with an offence is irresponsible for his act when the act is committed under an impulse which the prisoner was, by mental disease, in substance deprived of any power to resist.''

In dealing with the McNaghten rules, the committee said:

''In our opinion, the existing rule of law is sound; that a person may be of unsound mind and yet be criminally responsible. A crime no doubt implies an act of conscious volition; but if a person intends to do a criminal act, has the capacity to know what the act is, and to know the act is one he ought not to do, he commits a crime. Whether he should be punished for it is not necessarily the same question. We do not propose to discuss penological theories. We assume that two of the objects of punishment are to deter the offender and to deter others from repeating or committing the same offence. If the mental conditions we have pre-supposed exist, we think that punishment may be fairly inflicted. It is probable that the offender and others will be deterred. On the other hand, if the offender tends to escape punishment by reason of nicely balanced doubts upon a diagnosis of uncertain mental conditions, the observance of the law is gravely hindered. We are of opinion, therefore, that the present rules of law for determining criminal responsibility as formulated in the rules in McNaghten's case are, in substance sound.''

The report of the committee further adds:

''It was established to our satisfaction that there are cases of mental disorder where the impulse to do a criminal act recurs with increasing force until it is, in fact, uncontrollable. Thus cases of mothers who have been seized with the impulse to cut the throats of or otherwise destroy their children to whom they are normally devoted are not uncommon. In practice, in

* Life of Marshall Hall, page 377.
† 12 Cr. App. R., 165.

* 15 Cr. App. R., page 10.
† L.T., Vol. 156, page 399.

such cases the accused is found to be guilty but insane. In fact, the accused knows the nature of the act and that it is wrong; and the McNaghten formula is not logically sufficient. It may be that the true view is that under such circumstances the act, owing to mental disease, is not a voluntary act. We think that it would be right that such cases should be brought expressly within the law by decision or statute. We appreciate the difficulty of distinguishing some of such cases from cases where there is no mental disease, such as criminal acts of violence or sexual offences where the impulse at the time is actually not merely uncontrolled, but uncontrollable. The suggested rule, however, postulates mental disease; and we think that it should be made clear that the law does recognize irresponsibility on the ground of insanity where the act was committed under an impulse which the prisoner was, by mental disease, in substance deprived of any power to resist.''

The submission of the Medico-Psychological Association to the committee was:

''(i) The legal criteria of responsibility expressed in the Rules in McNaghten's case should be abrogated, and the responsibility of a prisoner should be left as a question of fact to be determined by the jury on the merits of the particular case.

(ii) In every trial in which the prisoner's mental condition is in issue, the judge should direct the jury to answer the following questions: (*a*) Did the prisoner commit the act alleged? (*b*) If he did, was he at the time insane? (*c*) If he was insane, has it nevertheless been proved to the satisfaction of the jury that his crime was unrelated to his mental disorder?''

On the other hand, the submission of the British Medical Association was:

''An act may be a crime although the mind of the person who does it is affected by disease or defective power if such disease or defect does not in fact prevent him: (*a*) from knowing and appreciating the nature and quality of his act or the circumstances in which it is done; or (*b*) from knowing and appreciating that his act is wrong; or (*c*) from controlling his own conduct unless the absence of the power of control is the direct and immediate consequence of his own default; but no act is a crime if the person who does it is at the time it is done prevented either by defective mental power or by any disease affecting the mind: (*a*) from either knowing or appreciating the nature and quality of his act or the circumstances in which it is done; or (*b*) from either knowing or appreciating that the act is wrong; or (*c*) from controlling his own conduct, unless the absence of the power of control is the direct and immediate consequence of his own default.

''N.B.—'Wrong' may mean (*a*) morally wrong; (*b*) illegal.''

In 1923 a bill embodying the amendments suggested by the Commission was introduced into the House of Lords by Lord Darling. It provided:

''1.—(1) A person is not responsible to the law for an act or omission charged against him as a crime, if, at the time of doing the act or of making the omission, he is proved to be suffering from such a state of mental disease as deprives him—(*a*) of capacity, at the time, to know, understand, and appreciate the physical nature and quality of the act done or omission made; or (*b*) of capacity to know, understand, and appreciate at the time that the act done or omission made was wrong; or (*c*) if, at the time the act was done or omission made he was suffering from such a state of mental disease as therefrom to be wholly incapable of resisting an impulse to do the act or make the omission.

''(2) A person who is suffering from mental disease at the time of doing the act or making the omission charged against him as a crime, and, by reason of such mental disease is affected by delusions on some specific matter or matters, but whose mental condition does not render him irresponsible to the law within the meaning of sub-sect. (1) of this section, is criminally responsible for such act done or omission made to the same extent and as if the facts with respect to which such delusions exist were real.''

Lord Hewart strongly opposed this bill. He spoke as one who had spent a lifetime prosecuting, defending and trying persons charged with crime, and particularly murder. He emphasized that the only cases relied on by the Atkin committee as justifying a change in the law were those where ''In practice, in such cases the accused is found to be guilty but insane''. His argument was that the recommendation of the committee and the purpose of the bill was to give only formal correctness to a kind of decision which in proper cases is found possible now. He said that in his view the proposed remedy was to open a door to a dangerous practice. He said:

''But I respectfully suggest that in practice, if this new limb were to be added to the alternatives set out in the Rules in McNaghten's case, it would be impossible to distinguish between the impulse of the person said to be suffering from mental disease, and the impulse of the ordinary offender who is moved to commit a crime by desire for gain or revenge.''*

The bill was ultimately withdrawn and has not been presented again. I think the failure to act on the recommendation of the committee was due to a realization in the British Parliament of something that is too often forgotten by many who frequently put forward idealistic conceptions of what the law ought to be. Law cannot be disassociated from its administration, nor can it be disassociated from the personality of the people by and for whom it is administered. It is idle to deal with any subject related to the law as if law is administered in a vacuum. It must be administered by and applied to human beings. It is infinitely better to have a poor law administered with wisdom and good judgment than a good law that is incapable of efficient administration. In considering any changes in the law it is always well to bear in mind what the purpose of all law is. Without attempting to give an exhaustive or comprehensive definition, it is sufficient to say that one of its main purposes is to regulate the manner in which the members of the human society live in association with

* Lord Hewart's Essays, page 230.

one another so that their maximum comfort and happiness may be attained.

I have real fear that the introduction of the doctrine of the uncontrollable impulse into our criminal law would create such a confused state of the law that the result would be that in all cases where the defence of insanity is raised, a wide field of investigation would be opened up, the boundaries of which would be incapable of delineation. Such a change would inevitably involve deep excursions into the realm of uncertain medical diagnosis and greatly enlarge the field for conflicting expert opinion. I have never forgotten a colourful phrase used by the late and much respected Dr. Beamer in an insanity case in which I was engaged. In answer to a question on cross-examination he said, "It is very difficult to tell where the twilight ends and the dark begins". In a recent official publication of the Department of Health it was stated, "Mental illness with its many types and gradations, is something that cannot be pinpointed, as diphtheria or a broken hip. In fact, the behaviour of the mentally ill is only an exaggeration of normal mechanism. They differ from the rest of us in degree not in kind".

If you apply a statement like that to the formula suggested by the Atkin Committee, the difficulties that a Judge and jury would have are abundantly clear. It is difficult to conceive how a tribunal of fact, in cases that do not come within the law as we now have it, could arrive at a conclusion with any degree of certainty as to whether the accused acted under an uncontrollable impulse due to mental disease or simply under an uncontrolled impulse.

I think it fair to say that if we had no capital punishment in Canada the subject I am now discussing would not likely have a place on your program. As I have pointed out, while there is a revulsion in the public mind against the execution of a man who commits murder while labouring under a disease of the mind, there is no similar revulsion in the case of one who is sent to prison for forging a cheque while under some delusion that would give him, if the facts believed were true, a right to sign the cheque. It is seldom, if ever, the law on this subject is discussed with reference to the whole criminal law and procedure. In most cases those discussing it proceed on the premise that all found guilty of murder are executed, which is just as far from the fact as that all young persons who are found guilty of theft are sent to gaol.

Within ten days after the imposition of a death sentence every trial Judge is required to make a full report to the Secretary of State for the information of the Minister of Justice, and in this report all relevant facts are stated. If the defence of insanity is raised in any aspect that is a matter of great importance to be drawn to the Minister's attention. In addition to this report the Minister receives a complete copy of the record at the trial, including all the evidence and the Judge's charge. In cases of doubt, it has not been unusual for the Minister to require further reports from duly qualified psychiatrists and on all the material he makes up his mind whether clemency should be recommended or not. The royal prerogative of mercy is just as much a part of the criminal law of Canada as section 19 of the Criminal Code. If executive clemency is exercised the accused is in the first instance confined to a penal institution from which he may be transferred to a mental hospital if his condition warrants such transfer.

May I respectfully suggest that the discussion of this subject should not be so much centred on whether the law should be changed, but rather directed to a consideration of whether its administration can be improved. In this respect I think great profit would be derived from close collaboration between the medical and legal professions.

I wish to make it abundantly clear that the suggestions I have to make are suggestions for consideration only. I have no considered views as to whether they would or would not be improvements. One could only arrive at such a conclusion after having the benefit of hearing all points of view fully discussed and that I have not had. I invite your consideration of the following points:

1. Where the issue of insanity is raised in criminal cases should a practice similar to that followed in Admiralty procedure be adopted, and the trial Judge have the right to have the assistance of psychiatrists who would sit with him as assessors for the purpose of consulting with him and advising him?

2. Should the accused have a right to elect to have the issue of insanity tried by the presiding Judge without the assistance of the jury?

3. Should the issue of insanity be tried in all cases by the presiding Judge without the assistance of the Jury?

4. Should legislation be adopted in Canada similar to s. 2, s.s. (4) of The Criminal Lunatics Act, 1884, now in force in Great Britain, providing that in the case of a prisoner under sentence of death, if it appears to the Secretary of State or Minister of Justice by any means that there is reason to believe the prisoner to be insane, two legally qualified medical practitioners shall be appointed to examine the prisoner and enquire as to his sanity and report in writing to the Secretary of State or the Minister of Justice with the appropriate certificate?

You will observe that this procedure is not dissimilar to that followed in Canada. The effect of such legislation would be to make the voluntary practice compulsory.

The Atkin Commission considered whether the provisions of the English Act ought not to be compulsory in the sense that no discretion should be left with the Secretary of State in respect of the recommendation of clemency where the medical doctors reported the prisoner to be insane. The Committee did not consider this suggestion favourably but was of the opinion that the discretion should still be with the Secretary of State. It was stated that in no case since the legislation was first enacted in 1840 had a prisoner been executed where medical practitioners had certified him to be insane under the provisions of the statute. Notwithstanding the absence of any such statute in Canada, I think it would be very difficult to point to a case in Canada during the last quarter of a century where the death sentence has been carried out in the case of a prisoner convicted of murder if it was shown on reasonable grounds that he was suffering from certifiable mental disease at the time the crime was committed.

There are in reality now many safeguards against a mentally diseased person being executed while at the same time the public is protected against future crimes being committed by those who cannot, by reason of mental disease, restrain themselves from violence. But in saying this, I do not wish to be taken to overlook the need for improvement in the treatment of mentally diseased prisoners during their confinement. This does not come within the ambit of the subject assigned to me.

May I respectfully emphasize that before any change is made in the law dealing with insanity as a defence in criminal cases, it is of first importance to be clearly convinced that the condition of the body politic of Canada will be better under the new law than it has been under the old. In a matter of this fundamental importance there is no room for experiment. Before we change the prescription we must be certain that the new formula will not produce other illnesses which will be worse than those from which we now suffer.

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## PATENT DUCTUS ARTERIOSUS

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WITH the advent of surgical treatment of persistent ductus arteriosus the accurate diagnosis of this condition has become increasingly important in clinical practice. In addition to the standard text books the current literature abounds with articles on diagnosis and differential diagnosis and yet mistakes are still made. This article deals with a small number of these cases, included among which are three in which the actual lesion found at operation was a defect in the aortic septum. This is surprising in that Maude Abbott found this defect in only 1% of her 1,000 cases.

The diagnosis of patent ductus should be possible with careful history, physical examination, x-ray studies and electrocardiogram. Oxygen saturation studies, angiocardiography and cardiac catheterization are available in only a few centres. With the rapid advances made in anæsthesia and if a competent thoracic surgeon is available diagnosis by means of exploratory thoracotomy offers a safer and more reliable method of making this diagnosis than some of the procedures just mentioned.

Our group consists of 18 patients, 17 of whom were explored with a tentative diagnosis of patent ductus arteriosus, and 1 patient who died of subacute bacterial endarteritis without surgical intervention.* In 11 cases a ductus

* These cases were operated upon by Dr. Ross Robertson, Department of Thoracic Surgery of the Vancouver General Hospital. The surgical aspects of these cases form the basis of his paper entitled "Surgical Treatment of Patent Ductus Arteriosus" published in the June, 1949 issue of *The Canadian Medical Association Journal.*

was found, ligated and divided. In 6 instances the preoperative diagnosis was in error. Of these 6 cases, in the light of our present knowledge, 3 would not now be explored. Thus, we are left with a stubborn core of 3 patients in whom accurate preoperative diagnosis is still elusive.

The cases have been tabulated in three groups. In Table I all cases with features "typical" of patent ductus arteriosus are listed. It includes 2 patients (Cases 15 and 16) who did not have that defect at operation. A group of 5 cases, in which certain atypical findings were present, is seen in Table II. Four of these were correctly diagnosed and 1 (Case 13) was thought to have a defect similar to that in Cases 15 and 16.

In Table III are all cases lacking a machinery murmur at the time of the last examination. Of these, 1 (Case 12) was found to have a subacute bacterial endarteritis engrafted on a functioning ductus. In 2 (Cases 17 and 18) no ductus was found. The operator palpated a rough thrill over the interventricular septum, suggesting interventricular septal defect. In Case 14 the thrill was maximal over the auricles posteriorly, and a tentative diagnosis of interauricular septal defect was made.

Typically, in patent ductus arteriosus, the murmur is described as continuous or machinery, with a systolic accentuation, best heard in the 2nd left interspace close to the sternum. The systolic component is frequently heard widely over the precordium and between the scapulæ, and is often transmitted into the neck vessels and left axilla.

When cases in which the ductus is complicated by other anomalies and infants are excluded, reported cases lacking the typical machinery murmur are not very frequent in the current literature.

Shapiro[1] notes the absence of machinery murmur in 1 patient who had a very large ductus at operation. In 1 case of a recently reported series[2] the diastolic component was very faint and only heard with difficulty.

In our series a "typical" continuous murmur was present in 9 of 12 cases of patent ductus (Cases 1 to 8 and 11) and found in 2 cases (Cases 15 and 16, Table I) in whom there was no functioning ductus at operation. In the latter the murmur differed in no respect from the other typical proved cases.

In 2 of the remaining 3 cases of patent ductus, certain atypical features of the murmur were present. In the first (Table II, Case 9), the murmur was distinctly not continuous, the systolic component was best heard in the 3rd left interspace close to the sternum, and the softer diastolic murmur heard only in the pulmonary area. In the second (Case 10), the machinery murmur was best heard in the 2nd right interspace close to the sternum. A softer systolic and a separate diastolic murmur were also well heard in the 3rd interspace to the left of the sternum. One patient who was thought to have an aortic septal defect at operation (Case 13) had a to-and-fro, non-continuous murmur, heard best in the 3rd left interspace at the sternal border.

In the final case, proved at autopsy (Case 12), although a continuous murmur in the pulmonary area had been recorded ten years be-

TABLE I.

CASES WHICH PRESENTED ALL THE FEATURES TYPICAL OF PATENT DUCTUS ARTERIOSUS

| *Case No.* | *Age sex* | *Murmurs Continuous with systolic accentuation, maximum in 2nd left interspace* | *Thrills Maximum in 2nd left interspace* | *Blood pressure* | *Pulse pressure* | *E.C.G.* | *Roentgenological findings* | | *Diagnosis Proved at operation* |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | *Cardiac enlargement* | *Evidence of increased pulmonary blood flow* | |
| 1 | 17.0 M. | Present | Present | 130/50 | 80 | No axis deviation | Present | Present | Patent ductus |
| 2 | 11.0 M. | Present | Present | 120/40 | 80 | No axis deviation | Present | Present | Patent ductus |
| 3 | 3.0 F. | Present | Present | 100/40 | 60 | No axis deviation | Present | Present | Patent ductus |
| 4 | 8.0 F. | Present | Present | 120/40 | 80 | No axis deviation | None | Present | Patent ductus |
| 5 | 19.0 F. | Present | Present | 140/60 | 80 | No axis deviation | Slight | Present | Patent ductus |
| 6 | 13.0 F. | Present | Present | 130/70 | 60 | No axis deviation | Present | Present | Patent ductus |
| 7 | 4.5 F. | Present | Present | 120/60 | 60 | No axis deviation | Present | Present | Patent ductus |
| 15 | 13.0 F. | Present | Present | 125/40 | 85 | No axis deviation | Present | Present | Aortic septal defect |
| 16 | 4.5 F. | Present | Present | 100/40 | 60 | No axis deviation | Present | Present | Aortic septal defect |

TABLE II.

CASES IN WHICH ONE OR MORE ATYPICAL FEATURES WERE PRESENT

| Case No. | Age sex | Murmurs | Thrills | Blood pressure | Pulse pressure | E.C.G. | Radiological findings: Cardiac enlargement | Radiological findings: Evidence of increased pulmonary blood flow | Diagnosis at operation |
|---|---|---|---|---|---|---|---|---|---|
| 8 | 9 F. | Continuous murmur with faint diastolic element. | absent | 120/50 | 70 | No axis deviation | Present | Present | Patent ductus arteriosus |
| 9 | 9 M. | Louder systolic, softer diastolic, discontinuous murmurs in 2nd left interspace, close to the sternum. Systolic component maximal in 3rd left interspace. | Systolic thrill in 2nd left interspace, and in episternal notch. | 100/50 | 50 | No axis deviation | Present | Present | Patent ductus arteriosus |
| 10 | 6 F. | Continuous murmur with systolic accentuation, in the 2nd interspace to the right of the sternum. Systolic and diastolic (discontinuous) murmurs also heard in the 3rd left interspace close to the sternum. | Soft systolic thrill in 3rd interspace to left of the sternum. | 90/15 | 75 | No axis deviation | Present | Present | Patent ductus arteriosus |
| 11 | 7 F. | Continuous murmur with systolic accentuation in 2nd left interspace. Rougher, louder systolic murmur in 3rd left interspace, close to sternum. | Maximum in 3rd left interspace, close to sternum. | 90/20 | 70 | No axis deviation | Present | Present | Patent ductus arteriosus |
| 13 | 7 F. | Loud systolic, with shorter early and mid diastolic murmurs, maximal in 3rd left interspace close to sternum. | Systolic maximum in 2nd and 3rd interspace, to the left of sternum. | 130/65 | 65 | No axis deviation | Present | Present | (?) Aortic septal defect |

TABLE III.

CASES IN WHICH NO DIASTOLIC MURMUR WAS PRESENT

| Case No. | Age sex | Murmurs | Thrills | Blood pressure | Pulse pressure | E.C.G. | Roentgenological findings: Cardiac enlargement | Roentgenological findings: Evidence of increased pulmonary blood flow | Diagnosis autopsy or operation |
|---|---|---|---|---|---|---|---|---|---|
| 12 | 23 F. | Loud systolic, maximum 3rd left interspace close to sternum. Continuous murmur was heard in pulmonary area 10 years before death. | Long pulmonary thrill felt 10 yrs. before death | 130/50 | 80 | No axis deviation | —— | Present | Patent ductus with subacute bacterial endarteritis |
| 14 | 12 M. | Loud blowing systolic, maximal in 3-4th interspace to the left of the sternum, widely transmitted. | Systolic thrill maximal in 3-4th left interspace close to sternum. | 125/60 | 65 | No axis deviation | Present | Present | ?Interauricular septal defect |
| 17 | 13 M. | Loud rough systolic, maximum in 2nd interspace on the left of the sternum, widely transmitted. | Systolic thrill maximal in 2nd left interspace close to sternum. | 125/60 | 65 | No axis deviation | Present | Present | ? High Interventricular septal defect |
| 18 | 4 M. | Loud systolic murmur, maximum in 3rd left interspace, close to sternum. | Systolic thrill maximal in 3rd left interspace, close to sternum. | 100/65 | 35 | No axis deviation | Slight | Present | Interventricular septal defect |

TABLE IV.

POSTOPERATIVE FOLLOW-UP

| Case No. | Follow-up period | Murmurs | Blood pressure: Pre-op. | Blood pressure: Post-op. | Roentgenological appearance: Heart and lung fields | Other |
|---|---|---|---|---|---|---|
| 4 | 5 months | Soft blowing pulmonary systolic—disappears with inspiration. | 120/40 | 120/75 | Unchanged<br>Decreased pulmonary vascular shadows. | Increased exercise tolerance |
| 5 | 6 months | None | 140/60 | 130/90 | Slight diminution in heart size. | Successfully completed full term pregnancy. |
| 6 | 5 months | None | 130/70 | 100/80 | Normal. Pulmonary vascular shadows decreased. | Increased exercise tolerance |
| 7 | 6 months | Soft blowing apical systolic murmur. | 120/60 | 90/70 | Unchanged | ——— |
| 9 | 6 months | Moderate blowing systolic in pulmonary area and episternal notch. | 100/50 | 95/70 | ——— | Growing rapidly. |
| 10 | 5 months | ——— | ——— | ——— | Heart decreased in size. Pulmonary vascular shadows diminished. | ——— |

fore death, the diastolic element was not heard at the time of the final admission to hospital. The murmur had apparently disappeared with the onset of subacute bacterial endarteritis.

A thrill, usually systolic, but sometimes carrying over into diastole, is frequently found in the pulmonary area, corresponding to the point of maximum intensity of the murmur. It is not uncommonly felt widely over the precordium and occasionally in the episternal notch. A typical thrill was found in all except 1 (case 8) of the proved cases in our group. It was maximal in intensity in the 3rd left interspace in 2 of these cases. A typical thrill was also found in 4 patients who did not have a patent ductus on exploration (Cases 13, 15, 16 and 17).

A low diastolic blood pressure with a normal or nearly normal systolic pressure is a fairly constant feature of this condition. This increased pulse pressure is frequently accompanied by a collapsing pulse and capillary pulsation. Although a wide range of both systolic and diastolic levels have been reported,[2] the increase in pulse pressure is principally at the expense of the diastolic level.

In this series an increase in pulse pressure was present in every instance. Although an increase in pulse pressure was a useful diagnostic point, it was not possible to differentiate the cases of ductus from those proved not to have a ductus on this basis alone. The average pulse pressure was 70 mm. of Hg. and the range from 50 to 80. The diastolic level averaged 45 mm. Hg. and ranged from 15 to 70. The mean systolic blood pressure was 116 mm. Hg.—the range was from 90 to 140. The pulse pressure usually increased on exercise as reported by Bohn.[3]

As a result of the left to right shunt, represented by a functioning ductus arteriosus, the circulation may be affected in various ways. If the shunt is small there may be only a slight increase in total volume of blood pumped from the left ventricle with little or no increase in cardiac size or in the vascular shadows in the pulmonary circulation. In more severe cases the shunt may accept up to 70% of the output of the left ventricle with a corresponding increase in the work of the heart, and in the size of the right and left ventricle, engorgement of the pulmonary arterial tree and increase in pulmonary arterial pressure.

In our series since the cases were chosen for operation a certain degree of pre-selection must have occurred. It is reasonable to assume that only the more severely handicapped patients were referred for surgery. It is not surprising therefore, to note that in all our cases some x-ray evidence of increased pulmonary blood flow or cardiac size was present. In 2 cases little or no cardiac enlargement was noted. However, in these instances there was good evidence of increased pulmonary blood flow (as seen by increase in size of the pulmonary artery, engorgement of the pulmonary vessels, or hilar dance). In assessing these factors observers differed somewhat in the interpretation of the x-ray and fluoroscopic findings. When, however, two principal observations alone were made, *i.e.*, cardiac size and evidence of increased pulmonary blood flow, there was general agreement.

In some cases there was marked increase in hilar vascular markings, with little or no increase in size of the pulmonary conus, and no hilar dance. In other cases the pulmonary conus was enlarged and vigorously pulsating without increase in hilar vascular shadow or hilar dance.

In Table IV are tabulated the significant features of the follow-up at the end of 5 to 6 months. It is seen that there is a uniform elevation of diastolic pressure with a decrease in pulse pressure. In some cases there has been actual diminution of heart size. Decreased pulmonary vascularity was present in four of these cases. A soft apical or pulmonary systolic murmur was present in 3 cases. The diastolic murmur had disappeared in all cases. These children were noted to be growing normally, and in those cases where the exercise tolerance had been thought to be normal the patients have exhibited an increase in activity. One patient became pregnant shortly after the operation and was successfully delivered of a normal full term infant.

The clinical diagnosis of uncomplicated patent ductus arteriosus may be regarded as an arch, the keystone of which is a continuous murmur, maximum in intensity in the 2nd left interspace close to the sternum, *i.e.*, in the pulmonary area. Typically this murmur has a machinery quality, the louder systolic component increasing in intensity during the latter part of systole. During diastole the intensity

of the murmur decreases, the louder systolic and softer diastolic producing the characteristic whirring or "machinery" sound. Frequently accompanying the murmur is a thrill which is best felt at the site of maximum murmur. It is usually palpable during systole, less commonly during diastole. The systolic component of the murmur is frequently widely transmitted. When loud it may be heard in the left interscapular area or high in the interscapular region posteriorly. It is also propagated out into the lung fields (along the distribution of the main pulmonary arteries), into the neck and into the axilla.

Supporting the diagnosis on the one hand there is an increase in pulse pressure. This is due in most cases to a decrease in the diastolic pressure with little or no increase in systolic pressure. This increase can be accentuated by exercise. The diagnosis is also supported by some evidence of increased pulmonary blood flow (prominent pulmonary conus, increased hilar markings, and in some cases hilar dance).

Below the diagnostic level are certain suggestive features. Absence of cyanosis and clubbing, normal axis in the electrocardiogram, stunting of growth, Corrigan pulse, and capillary pulsation, all tend to support the diagnosis.

While the diagnosis of patent ductus is usually relatively easy, certain factors may complicate the picture. During infancy the diastolic murmur may not be present. Other congenital anomalies may co-exist. Subacute bacterial endarteritis and congestive failure may modify the murmurs.

Because during infancy the diastolic pressure gradient between the aorta and pulmonary artery is low, only a systolic murmur may be heard. Later, with the increase in systemic diastolic pressure, the gradient increases to the point where there is a flow of blood from the aorta through the ductus into the pulmonary artery in both phases of the cardiac cycle, producing the to-and-fro murmur. Occasionally this is delayed until age 5 or 6 years. Therefore a definite diagnosis by clinical examination alone in this period of infancy may be hazardous in the absence of a continuous murmur. Isolated cases in which the diastolic murmur was absent even in adult life have been reported.[2, 5] This may be due to pulmonary hypertension possibly associated with a large short ductus.

The association of patent ductus arteriosus with other cardiovascular anomalies can produce a very confusing picture. If pulmonary stenosis co-exists the diagnosis may be impossible without further laboratory investigation. Levine and Geremia[2] describe a case in which the murmur was maximal in the aortic area and a well marked right axis deviation was found in the electrocardiogram. Studies involving catheterization of the heart permitted a diagnosis of patent ductus arteriosus, pulmonary stenosis and right aortic arch.

Patent ductus arteriosus may be associated with coarctation of the aorta. If the constriction in the aorta is distal to the ductus the circulation is similar to that of uncomplicated ductus, possibly with an increase in the volume of ductus flow. When, however, the ductus is distal to the constriction the flow of blood is reversed—the pulmonary circulation supplies the distal part of the body via the ductus. Burchell[6] described such a case. At autopsy the right ventricle was found to be grossly enlarged due to the increased work of supplying the caudal part of the systemic circulation.

Subacute bacterial endarteritis, particularly in its early stages, may obscure the correct diagnosis. The vegetations frequently begin at the pulmonary end of the ductus or in the pulmonary artery near its opening. They may modify the murmur even to the extent of abolishing the diastolic phase. The other evidence of bacterial endarteritis at this stage may be lacking, since the bacteria and vegetations are carried into the lungs and a positive blood culture may be unobtainable. The difficulties are well illustrated in Case 12. At the age of 13 years a continuous murmur had been observed in the pulmonary area and a diagnosis of patent ductus was made. In the next 10 years she suffered repeated attacks of rheumatic fever. She was finally admitted at the age of 23 years with gross hæmoptysis, cough and high fever. Multiple pulmonary abscesses were seen in the chest films and blood culture grew *S. viridans*. A loud systolic murmur was now heard without the previously noted diastolic phase. In view of the history of rheumatic fever and the murmur heard on this admission, the diagnosis was tentatively made of rheumatic valvulitis with subacute bacterial endocarditis. At autopsy she proved

to have a subacute bacterial endarteritis engrafted upon a patent ductus.

Finally, with the onset of congestive failure the murmurs may change. Here the aortic-pulmonary pressure gradient may decrease to the point where the diastolic phase of the murmur disappears. The correct diagnosis, then, of a patient first observed in this stage may be difficult or impossible. In any one particular case therefore, atypical findings may obscure the diagnosis. Errors may be made in two directions. The diagnosis of patent ductus may be made in the absence of that defect, or a diagnosis of some other defect may be made when in reality the underlying pathology is a functioning ductus arteriosus. The reports in the literature of patients, who, with a functioning ductus did not have a diastolic murmur, were responsible for three of our errors (Cases 14, 17 and 18). In one of these (Case 14) there was a history of a continuous murmur having been heard some years later.

Isolated cases of aortic septal defect have been reported[7, 8, 9] In Maude Abbott's series 10 of such cases are described forming 1% in 1,000 congenital defects. The abnormality consists of a small opening between the base of the ascending aorta and the pulmonary artery immediately distal to the valves. It is, therefore, apparent that the pathological circulation which results will be identical with that occurring in patent ductus arteriosus. There is a shunt of varying degree through this opening from the aorta to the pulmonary artery, and an increase in pulmonary blood flow, commensurate with the size of the opening and the aortic-pulmonary pressure gradient. A continuous murmur and thrill are found. Depending on the volume of the shunt one would expect an increase in the size of the heart, in the pulse pressure and in the pressure in the pulmonary artery.

### ILLUSTRATIVE CASES—AORTIC SEPTAL DEFECT

#### CASE 13

P.B., female, aged 7 years. Loud murmurs discovered in early infancy. Normal development. Referred for study because parents noted vigorous precordial pulsations.

*Physical examination.*—Weight 50.5 lb., height 49.5 inches (normal for age). A thrill primarily systolic but carried over into diastole was palpable in the 2nd and 3rd left interspaces close to the sternum. A loud systolic and a shorter blowing early and mid-diastolic murmur was heard over the same area, maximal in the 3rd interspace. The systolic murmur was widely heard over the precordium and faintly audible posteriorly. Blood pressure: arm 130/65 mm. Hg.; leg 175/80 mm. Hg. X-rays of the heart showed enlargement of the ventricles, predominantly left, prominent pulmonary conus and increased pulmonary vascular markings. No axis deviation was present in the electrocardiogram which was normal.

At operation, a functioning ductus was not present. A coarse thrill at the base of the aorta extending into the pulmonary artery was found. A provisional diagnosis of aortic septal defect was made.

#### CASE 15

R.S., male, aged 13 years. Murmurs detected at age 6 years. Referred for study because of shortness of breath on exertion and easy fatiguability.

*Physical examination.*—A systolic thrill maximal in 2nd and 3rd left interspaces close to the sternum. A continuous machinery murmur was present, maximal in the 2nd left interspace close to the sternum. Systolic element transmitted widely over the precordium into the neck and posteriorly over the dorsal aorta.

X-ray of the heart showed enlargement of both ventricles, prominent pulmonary conus and increased vascular markings. No axis deviation was present in the normal electrocardiogram.

At operation a functioning ductus was not present. At the base of the aorta a coarse thrill was palpable extending from the aorta into the pulmonary artery. The provisional diagnosis of aortic septal defect was made.

#### CASE 16

S.S., female, aged 4½ years. Murmur detected soon after birth. Referred for study because of poor rate of growth.

*Physical examination.*—Systolic thrill maximal in 2nd left interspace close to the sternum. A continuous machinery murmur maximal in the 2nd left interspace close to the sternum was heard. The systolic component was heard widely over the precordium, in the neck and in the interscapular area over the dorsal aorta. Blood pressures: arms 100/40 mm. Hg.; legs 140/40 mm. Hg.

X-ray examination revealed gross enlargement of the ventricles, predominantly left, with prominence of the pulmonary conus and increased pulmonary vascular markings. The normal electrocardiogram showed no axis deviation.

At operation a functioning ductus was not present. A coarse thrill originating in the aorta and extending into the pulmonary artery was found. Aortic septal defect was the provisional postoperative diagnosis.

### DISCUSSION

The problem of differentiating an aortic septal defect from that of a ductus on clinical grounds alone, poses many problems. It might be argued that in such cases the murmur and thrill would be maximum in a lower interspace and closer to the sternum. This was not observed in two of our cases (15, 16). When the murmur was found to be maximal in the 3rd interspace in the third case (13) it resembled several of our cases of ductus and was of no value in differential diagnosis. The localization of these murmurs does not correspond to their anatomical site, and other factors including propagation of a turbulent stream out into the pulmonary and aortic circulation do play an important rôle in determining the actual point on the chest where the murmur is best heard. The pulse pressure, electrocardiogram and

cardiac configuration did not help in differential diagnosis. Although calculation of the blood flow in the pulmonary and systemic circulation and oxygen saturation studies were not done in these cases, theoretically at least, they should not differ from the results obtained in patent ductus arteriosus. Experimental study of this problem will be the subject of a subsequent report.

### CONCLUSION

The diagnosis of patent ductus can usually be made on the facilities that are generally available. The important findings are the continuous murmur, the increased pulse pressure which shows further increase on exercise, the prominent pulmonary conus, with fluoroscopic evidence of increased pulmonary circulation. Certain negative findings are important and include the absence of cyanosis and the normal electrocardiogram.

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## TULARÆMIA—AN EPIDEMIOLOGICAL REVIEW

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WITH a recorded history of 37 years, tularæmia holds a unique interest for today's clinician, epidemiologist and medical historian. Several excellent reviews of this entity are available, those by Francis[1] in 1928, and Foshay[2] in 1940 being among the more complete. It is the purpose of this paper to consider the broadening epidemiological picture, the recent developments in the field of therapy, and finally to present a probable case of glandular tularæmia observed in the Province of Quebec during 1947.

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### EPIDEMIOLOGY

This disease occupies a rather unusual position in human pathology in that it was originally described in rodents. Only subsequently was it identified in man, in whom it occurs usually from direct exposure to infected animals or their ectoparasites. For convenience, this review will be arranged under the following topics: (1) Animals serving as reservoirs for, and sources of, infection. (2) Methods of transmission. (3) The picture in Canada: (*a*) epidemiological observations; (*b*) survey of reported cases.

1. The initial studies, and identification, of the etiological agent arose out of a plague survey in California in 1911-12. Here, in Tulare County, the organism was isolated from ground squirrels by McCoy and Chapin[3] and named *B. tularense*. (In keeping with present-day practice, it will be referred to in this paper as *Pasteurella tularensis*). The first case of human infection to be reported as such occurred in Indiana where Wherry and Lamb,[4] in 1914, described a case of ulcerative conjunctivitis in a meat-handler. Wherry[5] subsequently demonstrated tularæmia in two rabbit carcases found near the home of a second patient (also shown to have tularæmic conjunctivitis). Succeeding observers have continued to add to the growing mass of evidence indicting the rabbit as the primary source of human infection. Thus McDaniels[6] in 1931, in a review of a large series of cases in Illinois, found that 98.3% of the cases followed the handling of infected rabbits. Francis,[7] in 1937, stated that over 90% of all the cases in the United States were directly attributable to these animals and he estimated that about 1% of all wild rabbits were naturally infected.

Jellison and Parker[8] investigated the relationship between the distribution of tularæmia and that of rabbits (Order *Lagomorpha*). They state that, with very rare exceptions, only two genera, *Lepus* and *Sylvilagus*, are of epidemiological significance. The varying hares or snowshoe rabbits (*Lepus americanus*, etc.) are susceptible to infection with *P. tularensis* but are resistant to its lethal action. Their distribution bears no direct relationship to that of tularæmia. Both the jackrabbits (*Lepus spp.*) and the cottontails (*Sylvilagus spp.*) are much more vulnerable. The former undoubtedly serve as reservoirs of infection for vectors such as ticks

and biting flies as well as infection by direct contact. However, their significance is somewhat decreased by the fact that they inhabit areas of sparser human population, where the possibility of contact with man is lessened. On the other hand, the distribution of the cottontail closely parallels the incidence of the disease. On the basis of data on 14,002 cases reviewed in 1942 by Francis,[9] Jellison and Parker[8] estimate that 65.5% of cases occurred in areas virtually free of all rabbits save cottontails and the remaining 34% were found in areas inhabited by both jackrabbits and cottontails. Less than 0.3% of the cases occurred beyond the known range of the cottontails.

Notwithstanding the pre-eminent rôle of the wild rabbit, the epidemiological pattern will be modified by local factors, such as the available animal reservoirs and man's contact with them. The squirrel, opossum, woodchuck, muskrat, sheep, quail, grouse and several other vertebrates have been responsible for a small percentage of cases.[7, 10, 11]

2. It was evident from the earliest investigations that insects were vectors of importance. McCoy and Chapin[3] showed that fleas were the probable means of transmission among ground squirrels. Francis,[12] in 1919-21, demonstrated the vital rôle the deerfly (*Chrysops*) in the transmission of "deerfly fever" which he identified as "tularæmia". In addition, he isolated *P. tularensis* from lice of rabbits and mice, bedbugs, squirrel fleas, and stable flies (*Stomoxys*). Naturally infected ticks—the wood tick (*D. andersoni*), the western dog tick (*d. occidentalis*), and the rabbit tick (*H. leporis-palustris*)—were found by Parker *et al.* in 1924-29,[13] and they demonstrated that transovarial transmission was possible. Green,[11] in 1931, added the dog tick (*D. variabilis*) to this list. Francis,[7] however, in reviewing this aspect of the problem in 1937, doubted that the western dog tick, the rabbit tick and the rabbit flea were vectors of any significance.

Bell[14] has made an attempt to determine the factors involved in the infection of the dog tick (*D. variabilis*), in nature, and the possible relation of this to the periodic epizootics which are known to occur among wild rabbits. He was unable to establish any adverse effect upon the tick of *P. tularensis* infestation. Host immunity and the length of exposure of the tick to the host were both shown to be important in determining the level of tick infectivity. However, he could find no evidence of transovarial transmission of the infection.

Probably of greater significance in animal-to-man transmission is the contamination of hands, conjunctival membranes, etc., during the handling of infected animals. The exact mechanism does not appear to have attracted much attention, but infected blood and the fæces of infected ectoparasites would seem the most likely agents. Subsequent clinical reports[1, 7, 15] have verified the suspicions of Wherry and Lamb[4] that direct contact was the important method of transmission.

Other possible modes of transmission include the ingestion of inadequately cooked, infected food,[3, 7] the drinking of contaminated water,[7, 10, 15, 16] and the bite of an animal (ordinarily not infected) whose mouth has been, presumably, contaminated by chance exposure to an infected carcase.[1, 7] The possibility of inhalation infection has also been mentioned.[10, 11]

3. The Canadian epidemiological pattern would appear to differ appreciably from the American. In Alberta, where 58% of all cases reported to date in Canada have occurred, Bow and Brown[17] found that only 21 of a series of 40 cases could be attributed to contact with rabbits. This is in considerable contrast to the American figures which indicate that at least 90% of all cases reported in the United States have been due to direct contact with rabbits. Evidently, a search for additional factors must be made before a complete picture of the situation in Canada can be presented.

A study of the distribution of wild rabbits in Canada was made by Jellison and Parker.[8] They state that jackrabbits are found in a small area of British Columbia, south of Kamloops, and in southern portions of Alberta, Saskatchewan and Manitoba. According to Anderson[18] the cottontail is found in southern Ontario and southeastern Quebec and has gradually spread north to the foothills of the Laurentian plateau. Jellison and Parker[8] believe that the cottontail range also includes small portions of southern Alberta and Saskatchewan. The small size of these areas and the lack of any clear relationship with the distribution of human cases of tularæmia as was found by Jellison and Parker in the United States[8] substantiates, indirectly, the conclusion

that a material difference between the two countries exists.

The investigation of the epidemiology of tularæmia in Canada has already yielded some interesting findings. Parker, Hearle and Bruce,[19] in 1931, isolated *P. tularensis* from a snowshoe rabbit in southern British Columbia. Gibbons,[20] in 1939, demonstrated the infection in ticks. In 1941-42, the organism was recovered from a jackrabbit, ticks and sheep in south-eastern Alberta.[21]

Burroughs *et al.*,[10] in 1945, listed the following vertebrates known to be naturally infected in Canada: Franklin gull; Osgood whitefooted mouse; varying hare; Richardson ground-squirrel; Drummond meadowmouse; whitetailed jackrabbit.

In a survey of specimens collected in British Columbia, Alberta and Saskatchewan in 1946, Humphreys and Campbell[22] encountered *P. tularensis* in wood, dog and rabbit ticks, ground squirrels, meadowmice, a deermouse, a house mouse, rabbit tissues and a Franklin gull. Bow and Brown,[16] in a pilot survey of waters in southern Alberta and Saskatchewan, were unable to demonstrate any contamination with *P. tularensis*, but they observed the close proximity of known reservoirs of infection and the potential hazards therein involved. On the basis of case histories, several other sources have been suspected, including muskrats, raccoons, mink and, less probably, fresh vegetables,[23] hogs (mouth and tongue),[24] domesticated rabbits,[25] and the McKenzie red squirrel.[26]

The foregoing observations, though incomplete, would seem to indicate that, in this country, the sources of infection are more diversified, their distribution more irregular and man's contact with them more haphazard than in the United States.

## HUMAN CASES

Considerable difficulty has been met with in attempting to collect all the reported human cases in Canada. Only a brief summary can be presented here.

Grant and McLean,[27] in 1935, noted the occurrence of periodic epizootics in the rabbit population in Nova Scotia but state that no etiology was ever demonstrated. They report two probable cases in man in which the diagnosis was based upon history and one positive agglutination, made four years after the illness. The source of the infection in both cases was apparently rabbits.

Jenkins,[28] in 1939, reported two cases from Quebec but no further data are available. At the same time, he recorded a total of 15 cases in Ontario, including the first case to be described in Canada.[29] The literature contains further information on nine of these and among the suspected sources are muskrats (3 cases), mice (2 cases), rats, raccoons, mink, wild and domestic rabbits and fresh vegetables.[23, 25, 29, 30, 31]

Bow and Brown[17] reviewed all the cases in Alberta up to June, 1944—including 15 previously reported.[15, 21, 24, 32 to 35] They found 35 definite and 5 probable cases, and state that, of these, 21 were presumably due to the handling of rabbits. They also call attention to previous reports[21, 32, 35] which illustrate the rôle of the wood tick as a vector in tularæmia.

Gibbons,[20] in 1939, reported 3 cases in British Columbia while Jenkins,[28] in the same year, put the total to 4. One case, reported by Ootmar[36] was believed due to a deerfly bite. In another case,[37] the source was thought to be the bite of a cat fed the carcase of a snowshoe rabbit found dead in the woods.

TABLE I.

| *Date* | *Laboratory* | *P. tularensis* | *B. abortus* |
|---|---|---|---|
| July, 1947.... | Queen Mary Vet... | —— | neg. |
| Oct. 24, 1947.. | D.N.H. & W. Lab... | 1:300 | neg. |
| Nov. 28, 1947. | D.N.H. & W. Lab... | 1:300 | neg. |
| Jan. 12, 1948.. | D.N.H. & W. Lab.. | 1:600 | neg. |

MacKinnon,[26] in 1947, reported two probable cases from Norman Wells, North West Territories. The histories noted contact with McKenzie red squirrels but only one agglutination was done and no further epidemiological investigation was made.

## THERAPY

For many years, the only measure of any therapeutic specificity was Foshay's hyperimmune serum,[2] and the mortality rate in most large series was around 6%.[9] Most of the fatalities were due either to the acute toxæmia accompanying the initial septicæmia or to pulmonary, meningeal or gastro-intestinal complications, which might be encountered in any of the four clinical types of the disease.

Heilman,[38] in 1944, showed that *P. tularensis* was highly sensitive, *in vitro*, to streptomycin, and demonstrated some protection against experimental infections in mice. The first clinical trial of streptomycin was favourably reported by Foshay and Pasternack[39] in a small group of cases in 1946. Favourable clinical reports accumulated rapidly and by September, 1946, the Committee on Chemotherapeutics was able to state that, ". . . streptomycin . . . is by far the best therapeutic agent available for the treatment of this disease (tularæmia)".[40] The whole question of therapy was ably reviewed by Foshay in 1947[41] and he asserts that, "Streptomycin approximates the ideal therapeutic agent for tularæmia". There would now appear to be little doubt but that tularæmia has been conquered in a therapeutic, if not prophylactic, sense.

## CASE REPORT

The patient was a 29-year old male who worked as a day labourer in the Laurentian region around Val d'Or, Quebec. He was perfectly well up to July 2, 1947, when he noticed the onset, over the course of 8 to 10 hours, of chills and fever, headache, marked malaise and a painful swelling on the back of his neck. With progression of these symptoms, he was admitted to a local hospital about 36 hours after the onset, at which time his temperature was 103° F. After 6 days of treatment, which included the administration of sulfonamides and penicillin, his condition showed little change save a moderate decrease in temperature, and his transfer to Montreal was recommended.

He was admitted to the Queen Mary Veterans' Hospital on July 11, 1947, the ninth day of his disease. Examination revealed a low-grade fever and a large, tender swelling under the right sterno-mastoid muscle and extending into the posterior cervical triangle. The mass was about 5 x 3 cm. in size, firm, non-fluctuant and extremely tender. The overlying skin was not reddened or adherent. There were several small, tender glands in the right posterior cervical and left post-auricular regions. In the right occipital area, at the site of the suspected insect bite, there was a tender subcutaneous nodule. These were no superficial lymph glands or physical findings of note elsewhere. Roentgen examination of the chest was negative.

Laboratory investigation revealed a hæmoglobin of 12.9 gm., white blood count of 9,400 with 83% neutrophiles and a sedimentation rate of 40 mm./hr. (uncorrected). Urinalysis and Kline exclusion tests were negative. Mantoux test was positive in a dilution of 1:100. Typhoid, paratyphoid and brucella agglutinations were essentially negative. Biopsy of a posterior cervical lymph node on August 1, was reported as follows: "Sections show a very mild degree of reticular lymphoid hyperplasia. The most striking change is an area of necrosis in the centre, ringed with epithelioid cells. However, no giant cells and no typical follicles were found. Though the microscopic appearance is strongly suspicious of an acid-fast infection, no definite diagnosis of tuberculous lymphadenitis can be made on this biopsy. Special stains failed to show any acid-fast bacilli."

During his first week in hospital, his temperature gradually fell to normal. The masses in the neck became less acutely tender and subjectively, his condition improved. Except for a brief episode of left femoral thrombophlebitis, his subsequent hospital course was uneventful. As these masses became fluctuant, aspiration at intervals from the 7th to the 17th week after onset would yield thick, greenish-yellow, purulent material which was repeatedly sterile on smear, culture and guinea-pig inoculation.

Careful inquiry into the history failed to reveal any contact with rabbits or wild rodents, any residence in a known endemic area, or any past illness which might have been interpreted as tularæmia. He did state, however, that he had spent the night preceding the onset of his illness in a shack in the woods and on awakening, noticed on the back of his neck a small, itchy, slightly tender swelling which he assumed to be an insect bite. He stated that deerflies and snowshoe rabbits abound in the Val d'Or region. On October 24, 1947, the first of several blood samples was taken for *P. tularensis* agglutination (see Table I). Following receipt of the result (Nov. 1), the patient was given a course of streptomycin—2 gm. daily in 5 divided doses for 20 days. On completion of this therapy, there was moderate but distinct reduction in the size and tenderness of the masses. There was no apparent toxic reaction to the streptomycin and the patient was subjectively unchanged. When seen in the out-patient department on January 12, 1948, there appeared to be some further though slight reduction in the size of all the glands, they were no longer tender and the patient had remained well in the interval.

## DISCUSSION

In the case presented above, the history of onset and clinical course of the disease, the clinical characteristics of the glands, and the pathological picture of the gland, which closely resembles that of tuberculosis[1] would favour a diagnosis of tularæmia of the glandular type. The presence of *P. tularensis* agglutinations must be interpreted with caution. Their notable persistence after infection is widely recognized. In the absence of a demonstration of their presence in a rising titre earlier in the course of the disease, one is permitted to say only that the findings are consistent with the diagnosis of tularæmia. The failure to isolate the causative organism from the glands is equally equivocal. Both Francis[9] and Foshay and Mayer[42] reported the isolation of *P. tularensis* from lymph glands at intervals from 2 weeks to 5 months after onset. However the former noted that ". . . numerous failures have been reported after the first month".

On the other hand, there is no history of exposure to any known source of tularæmia or to any vector except, perhaps, a deerfly. This, however, has never been shown to be naturally infected in Eastern Canada. Anderson[18] states that the cottontail is gradually spreading north into the Laurentian Plateau. Very possibly, a hitherto unsuspected reservoir of tularæmia is becoming established in this region. If that is the case, we may well expect to see more cases since this region is undergoing considerable development at the present time.

## SUMMARY

1. A brief review of the epidemiology of tularæmia as it is seen in the United States is presented.

2. The observed differences in the epidemiological pictures in Canada and the United States are noted. The wild rabbit is shown to be of lesser importance as a source of infection in Canada and the work on other factors is examined.

3. All cases reported in Canada since 1930 are reviewed and the total placed at 65. Of the 55 of these sufficiently well documented to analyze, 24 or 44% were probably due to contact with wild rabbits.

4. A case of regional lymphadenitis is presented, in which it is considered that the etiological diagnosis of tularæmia is probable,

though it could not be conclusively demonstrated.

5. The possibility that an unsuspected reservoir of infection is in the making in the Laurentian Plateau is suggested.

I should like to thank the Department of Veterans' Affairs and Dr. W. H. P. Hill for permission to publish the case and especially Dr. Hugh Starkey for his encouragement and constructive suggestions during the preparation of this paper.

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RÉSUMÉ

L'auteur fait une étude épidémiologique de la tularémie aux E.-U. et au Canada depuis la découverte de cette maladie. Il note qu'aux E.-U. la tularémie est causée par le lapin sauvage dans 90% des cas et seulement dans 44% au Canada. Il rapporte ensuite un cas probable de tularémie à forme glandulaire observée dans la province de Québec et traité à la streptomycine. La source d'infection aurait été un insecte non identifié.

YVES PRÉVOST

## MESENTERIC TUMOURS

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THESE tumours may be solid or cystic. This paper concerns itself largely with the cystic group. Mesenteric tumours occur between the layers of the mesentery or under the serosa of the intestinal tract. Retroperitoneal tumours are excluded by definition. The masses may occur anywhere along the intestinal tract but the majority occur in the mesentery of the small intestine. They have, however, been found in connection with the large bowel, appendix and gastro-hepatic mesenteric connections.

There are numerous tissues which have been found to be responsible for mesenteric tumours. Probably the largest group, of course, are the malignant growths. Most of these are metastatic growths involving the lymph glands. These are of relatively little importance *per se* because they are only incidental in the course of the original disease. The other group of malignant tumours are those which originate in the mesenteric space. These are sarcomatous in nature. Either of these groups may be solid or become cystic by degeneration.

The second group is made up of retroperitoneal structures, remnants of which have become incarcerated between the layers of the mesentery and grow to form tumours. Fragments of Müllerian body, Wolffian duct and ovary have been found in this group. Dermoid cysts have been reported and are usually believed to originate from misplaced ovarian tissue, since all cases have been found in women.

The third group are of an infectious nature, such as large tuberculous glands, echinococcus cysts or ordinary abscesses encapsulated between the layers of the mesentery.

The fourth group comprises the one of most importance both from the question of etiology and the causation of symptoms, unassociated with any other disease. This group consists of the true mesenteric cysts. They are not malignant, dermoid or parasitic and they do not consist of structures which are normally retroperitoneal. They are usually divided into two groups. The first is believed to consist of intestinal diverticulæ which become sequestrated from the bowel during development. They are, therefore, embryonic in origin and

grow with the course of time. Thus a cyst is formed which contains elements similar to the adjacent bowel, that is, muscular layer, mucosa, goblet cells, etc. These are referred to as enterogenous cysts.[1]

The other group includes the serous, chylous, lymphatic or hæmorrhagic cysts. The origin of these is open to doubt. They may originate from a dilated receptaculum chyli, lymphangiomatous growth, blocked lymphatic channels, cystic degeneration of a lymph gland, etc. They may be lined with a single layer of epithelial cells or this may be destroyed by pressure. The wall is usually made up of fibrous connective tissue with both lymph channels and blood vessels. The contents may be bloody, greasy or chylous in nature, sometimes becoming concentrated and thickened. In any event, the contents prove nothing as to the origin of the cyst, since both chyle and blood may escape into its lumen from the channels contained in the wall. In the case of older cysts the wall may become partly calcified and this may be of aid in demonstrating them radiographically. For sake of convenience, this group will be referred to as chylous cysts.

The frequency[2] of chylous and enterogenous cysts is difficult to estimate, but they are, undoubtedly, among the surgical rarities.[3 to 8] In 1935 Judd[2] quoted by Roller[9] reported 8 mesenteric cysts in 820,000 admissions to the Mayo Clinic. There were 25 mesenteric tumours of all types (cystic and solid) reported in these admissions. That is, solid tumours are about three times as common as cystic ones, in the mesentery. The Children's Hospital in Los Angeles[10] reported three cases of mesenteric cysts in 12,425 admissions. Loeb[11] reported one case in 105,000 admissions at the Bronx Hospital. He estimates about 500 or 600 cases of mesenteric cysts had been reported up to 1941. The frequency of enteric cysts as compared to chylous cysts seems to be rather difficult to estimate. This is partly due to the fact that the pathological diagnosis in many cases is stated as undifferentiated mesenteric cyst. One would get the impression from reviewing the literature that chylous cysts are probably the more frequent. However, Guthrie and Wakefield[12] in a study of cysts in guinea pigs and those obtained from human cases discovered evidence of enteric tissue in the large majority, indicating their origin from the intestinal tract. It may be, that even the so-called chylous cysts, originate from the intestinal tract, but due to pressure on the wall of the cyst from within the lining cells and cellular elements in the wall are destroyed and replaced with fibrous tissue. The presence of lymphatic tissue in the walls of such cysts is, of course, entirely compatible with an intestinal origin. The location of chylous and enteric cysts is the same as that of mesenteric tumours in general. That is, they may occur anywhere along the intestinal tract but the mesentery of the small bowel is, by far, the commonest location. They have been found in the fetus, the child and the adult. Both sexes are equally afflicted.

Symptoms are notoriously vague and nonconclusive. As a result, the true nature of the condition is rarely diagnosed correctly before operation. Attention is usually focussed on the abdomen when complications begin. However, if the cyst happens to reach a fairly large size before complications develop, it might be detected by a feeling of fullness noticed by the patient, discovered by routine palpation of the abdomen, or discovered by x-ray during the course of a gastro-intestinal series or intravenous pyelography. In the first case mentioned below periodic attacks of epigastric pain with nausea and vomiting caused the patient to seek medical advice. An indefinite mass could be felt in the region of the navel and a gastro-intestinal series revealed the cyst. Porter[13] states that nausea and vomiting are more common with mesenteric cysts than with any other intra-abdominal cyst.

However, most cases are essentially asymptomatic until the advent of complications. The commonest complication is intestinal obstruction[14] due to pressure or twisting. Other complications are peritonitis due to rupture of the cyst or following intestinal obstruction. Hæmorrhage into the peritoneal cavity or into the cyst: torsion of the cyst: incarceration of the cyst in the pelvic cavity.[15] The symptoms of these complications are well known and produce what might be called a surgical or acute abdomen to a greater or lesser degree. As a result, most cases are operated upon in the acute stage and the cause of the complication is not suspected until the cyst is revealed.

The differential diagnosis is of most interest in connection with those cases that have not developed complications. In the latter cases, the seriousness of the complication necessitates

operative interference regardless of the cause. The presence of a cyst adds little or no difficulty to the technique of the operation. However, in the non-complicated cases, the surgical attack upon the cyst can be better organized if its origin can be determined. Tumours or cysts of stomach, gall bladder, liver, pancreas, intestine, retroperitoneal structures, kidneys and pelvic organs constitute the main diagnostic problem. In the first place, a flat plate of the abdomen may confirm the presence of a suspected mass.[16, 17] If calcium is present in the walls it may outline the wall, thus revealing its cystic nature. Gastro-intestinal series with gall bladder dye and barium enema and intravenous pyelography are of value in exonerating these organs. In Case 1 below, x-ray studies demonstrated clearly that the mass was seperate from any of these structures. Mesenteric cysts are freely movable, thus differentiating them from pancreatic cysts and pseudo-cysts. Again in Case 1, this was clearly demonstrated in the different x-ray pictures. Ovarian cysts may offer difficulty in the differential diagnosis. A mesenteric cyst may become incarcerated in the pelvis, making it impossible to distinguish it from a cyst arising from the pelvic organs. In Case 2, the preoperative diagnosis was ovarian cyst on a long pedicle.

The treatment, of course, is surgical. Complete removal is the operation of choice but marsupialization[18] and aspiration have in the past been done in cases where removal was unwise or impossible. The mortality rate is given as approximately 35% but, of course, this is in cases complicated with intestinal obstruction and gangrene. In non-complicated cases, the mortality rate should be nearly zero. This is an argument in favour of removal even if asymptomatic at the time of discovery. Aspiration is usually condemned and has probably only been done in the earlier cases since if complete removal is impossible, then marsupialization can usually be done.

The operation, if the condition is complicated with intestinal obstruction, may involve intestinal resection and anastomosis, enterostomy, etc. If not complicated, the operation consists of enucleating the cyst from the layers of the mesentery and covering the raw surface left with peritoneum. In many cases there may be several cysts making their removal more difficult. It is also these cases that are more likely to be complicated with intestinal obstruction.

CASE 1

Mr. L.B., aged 50, entered the Memorial Hospital, St. Thomas, on July 3, 1947, because of periodic attacks of abdominal pain, nausea and vomiting which started in 1940 and had recurred every 4 or 5 weeks since that time. The pain was cramp-like in character, located around the epigastrium and lasted about 3 or 4 hours. This was followed by 3 or 4 loose bowel movements and

**Fig. 1.** (Case 1).—X-ray showing gall bladder and the cyst lying to the right of the vertebral column.

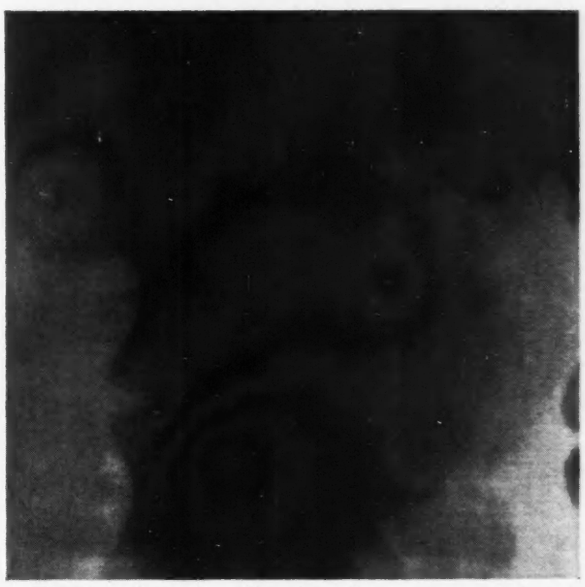

**Fig. 2.** (Case 1).—Showing the cyst now lying to the left of the vertebral column.

the attack was over. This man was admitted to hospital in 1940, a short time after his attacks began. The diagnosis at that time was gall bladder disease. Unfortunately, no x-rays were taken and the presence of an abdominal mass was not mentioned at that time.

Examination of this patient in 1947 revealed a very well-nourished middle-aged male in no apparent distress. The only pertinent physical finding was an ill-defined mass and some tenderness just above the umbilicus. Gall

bladder and gastro-intestinal x-rays revealed the mass which was not connected in any way with the gall bladder, stomach, or intestinal tract. An intravenous pyelogram proved that it was not arising from the kidneys. The x-rays further revealed that it was fairly freely movable (see Figs. 1 and 2) and a diagnosis of mesenteric tumour was made. This was confirmed at operation when the mass was found to be a cyst between the layers of the small bowel mesentery located in the jejunal part of the mesentery and well back towards the root. The mesenteric layer was stripped off and the cyst shelled out without too much difficulty. The peritoneum was closed over the defect and the abdomen was closed without drainage. Recovery was uneventful and he was discharged on July 19, 1947. Since that time his health has been excellent and he has been free from his previous attacks. The following is the pathological report:

Specimen consists of an ovoid mass measuring 6.4 cm. in diameter. Its surface is smooth except for a few adherent fatty and fibrous tags in places. The wall averages approximately 0.2 cm. in thickness. The lumen is filled with a soft yellowish, putty-like material.

*Microscopic.*—Microscopic sections show portions of the wall of a cystic structure, without any epithelial or endothelial cell lining. The wall is composed of fibrous tissue and contains a few muscle cells. There is an infiltration of lymphocytes and lymphoid tissue in the outer layers of the wall. In view of the clinical history, contents of the cyst and histological structure we feel the picture corresponds with that of a chylous cyst. There is no evidence of malignancy. The only thing which might be added is in connection with the muscle cells found in this specimen. They might be considered as evidence that this is an enterogenous cyst rather than a chylous one. That is, the muscle cells originate from the intestinal tract.

### CASE 2

Mrs. E.R., aged 29. This young woman was admitted to the St. Thomas Memorial Hospital on June 6, 1945, with a diagnosis of ovarian cyst. Two months previous to admission she had noticed some indigestion, a swelling in the lower abdomen and a loss of 2 to 3 pounds in weight. Her previous history was non-contributory. Examination revealed a rather thin young female with a rather prominent mass in the lower abdomen. Pelvic examination suggested the mass to be an ovarian cyst on a long pedicle allowing it to lie out of the pelvis. The rest of the examination and laboratory work was negative. No radiographs were taken. Operation revealed, however, that the mass was a cyst, located in the jejunal mesentery and was freely movable. It was removed by splitting the mesentery over it and shelling it out. The mesenteric layers were closed and the abdomen closed without drainage. Recovery was uneventful and the patient has remained well over the subsequent three years.

The following is the pathological report: The specimen consists of a mass measuring 9 x 8 x 7 cm. which is creamy in colour. On section, the mass is a single cyst, filled with creamy fluid, and showing a thin fibrous wall. In the wall, are a few small cysts filled with similar fluid. Sections show a lining of a single layer of very flattened cells. The wall is made up of myxomatous tissue, with a few strands of collagen, and a scattering of lymphocytes. Numerous capillary vessels are seen.

Pathological diagnosis, chylous mesenteric cyst.

### SUMMARY

1. A brief classification of mesenteric tumours is given and their incidence is discussed.

2. The differences between chylous and enterogenous cysts are outlined.

3. Symptoms, complications, differential diagnosis and treatment are dealt within the light of present knowledge.

4. Two cases are presented. One probably represents the enterogenous variety; the other is a chylous cyst.

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## URETERAL ECTOPIA*

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THERE are now over three hundred cases of ureteral ectopia listed in the literature. The case to be reported is the first one recorded at the Hamilton General Hospital. No cases are on record at St. Joseph's Hospital. The condition occurs predominantly in females, the reported incidence being 2:1. This, however, may not be a true statement of fact because in male patients the ectopic ureteral opening more often is proximal to the external sphincter, and therefore produces no symptoms, except at times pyuria, while in females the ectopic opening, usually being distal to the external sphincter, produces urinary incontinence, and is therefore more easily recognized. Probably more cases would be discovered if every case of recurring pyuria in the male, and of urinary incontinence in the female, were carefully examined with this condition in mind.

### EMBRYOLOGY

*Embryology.*—A knowledge of the embryology of the genito-urinary tract is essential to understand the formation and symptoms of this disorder. Fig. 1 illustrates a cross-section of a 2.4 mm. embryo, and shows the intermediate cell mass which develops to form the primary kidney or pronephros, the intermediate kidney or mesonephros with its excretory duct, the mesonephric duct, and finally the permanent kidney or metanephros. Fig. 2 illustrates, in longitudinal section, a 1.7 mm. embryo. This shows the development of the intermediate cell mass into the primary kidney and the be-

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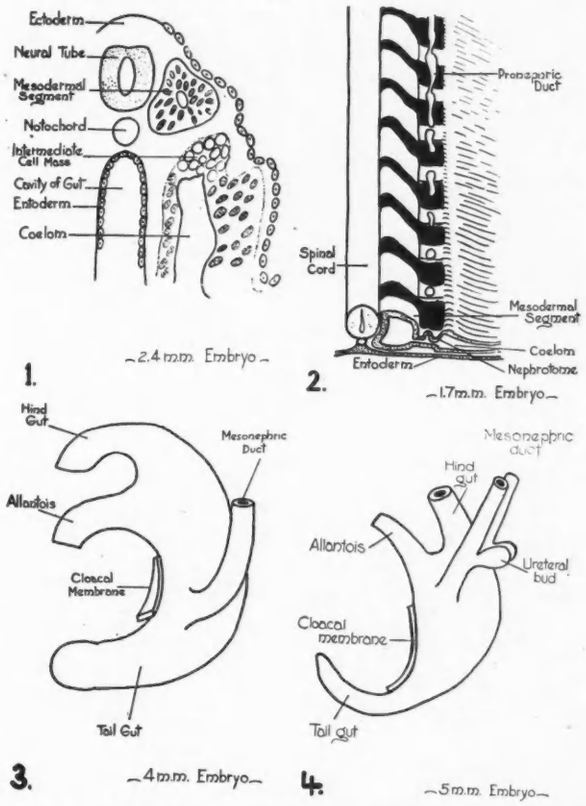
ginning of the excretory duct. This kidney is non-functioning in the human and quickly disappears. The duct, however, developing further, remains to serve the secondary kidney and becomes the mesonephric duct. It grows caudalward to enter the cloaca.

Figs. 3, 4, and 5 represent the cloaca, the opening of the mesonephric duct, the ureteral bud and its development. They also show the beginning division of the cloaca into the rectum and urogenital sinus. The ureteral bud arises from the postero-medial wall of the mesonephric duct near its junction with the cloaca. This bud grows dorsally, and at the same time its origin migrates to the posterior, and later to the postero-lateral, wall of the mesonephric duct. With further development the lower end of this duct expands to form part of the bladder, and thus the ureter finally opens into this viscus. It is due to faulty origin of the ureteral bud, failure of its migration, or its tardy ap-




pearance after the lower end of the mesonephric duct becomes part of the bladder, that an ectopic ureteral opening results.

Ureteral duplication may be due to a splitting of the original ureteral bud, or it may be due to a second ureteral bud occurring at a somewhat later stage. If this second bud appears after the lower end of the mesonephric duct has been taken up by the bladder, it will become an ectopic opening and will enter the structures derived from the mesonephric duct.

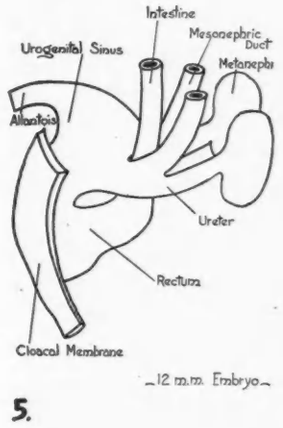
Fig. 6 represents the reconstruction of the caudal end of a 25 mm. embryo, showing the complete separation of the rectum and urogenital sinus, and the relation of the urogenital ducts. The ureter is seen to enter the bladder. The mesonephric duct, which persists as the male genital duct, is seen to enter the urethra in a position more medial and more distal than that of the ureter. Also in this drawing is seen the Müllerian or female genital duct entering the urogenital sinus just medial to the mesonephric duct. The Müllerian duct forms in embryos of 10 to 11 mm. and runs from the undifferentiated sex gland to enter the urethra. Thus embryos of 25 mm., as illustrated, have both male and female genital ducts.

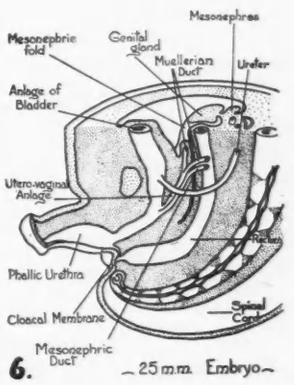
As the male embryo develops the Müllerian ducts degenerate, except for small portions cranially and caudally, which persist respectively as the appendix testis and the vagina masculina. The mesonephric duct persists and forms the epididymis, vas deferens, seminal vesicle and ejaculatory duct, and it is in these structures that an ectopic ureteral opening may be found in the male.

As the female embryo develops, the mesonephric duct degenerates, except for the vestigial Gärtner's duct and two other unimportant structures. The Müllerian ducts become the functional ducts. The lower ends fuse, and, with their middle portions, form the vagina and uterus. Their upper portions persist as the paired uterine tubes. It is in these structures, formed from the Müllerian ducts, that an ectopic ureteral opening may be found in the female.

The urethra in both sexes may also be the site of an ectopic ureter. No cases are on record of ectopic ureters opening into either the epididymis or uterine tubes as these structures are formed from the cranial end of their respective ducts.

*Pathology.*—In about 60% of the reported cases, renal and ureteral duplication, either unilateral or bilateral, has been present. The co-




existence of other anomalies involving the genital and urinary tracts is not infrequent. In most cases the kidney drained by the ectopic ureter is hypoplastic or hydronephrotic. Stasis of urine is common, resulting in infection in the majority of cases. The orifice may be extremely small and very difficult to visualize. There is usually marked dilatation of the ureter above its narrow outlet. Inflammatory changes are common.

*Symptoms.* — In ureteral ectopia, symptoms will be dependent upon disturbances of urinary control or urinary infection, or a combination of the two. With the resulting dilatation and urinary stasis, infection is a common finding, so that frequency, fever, and chills are evident. In many cases, pain and tenderness of an intermittent character are present in the renal area. The symptoms of urinary infection may constitute practically the entire clinical picture in the male, as these patients are not troubled with

incontinence of urine. In the female, however, the chief symptom is usually incontinence of urine, and this is co-existent with normal voiding. The urinary leakage may not be present at all times. In some it may be experienced only while up and about, whereas in others it may be evident only while recumbent. In other cases, like the one to be presented, the incontinence may not develop until adult life is reached. In children, on the other hand, functional enuresis is often erroneously diagnosed.

*Diagnosis.*—Cases of recurrent pyuria in the male and incontinence of urine in the female, particularly when associated with normal voiding, should be carefully examined, with ureteral ectopia in mind. Intravenous pyelography, as a rule, will provide the most valuable diagnostic clue, but, in those cases where the offending segment or kidney has little or no function, this method of examination will fail. Careful urethroscopic examination, along with very minute inspection of the vestibule and vagina, often aided by the intravenous injection of indigocarmine, will lead to the diagnosis in most cases.

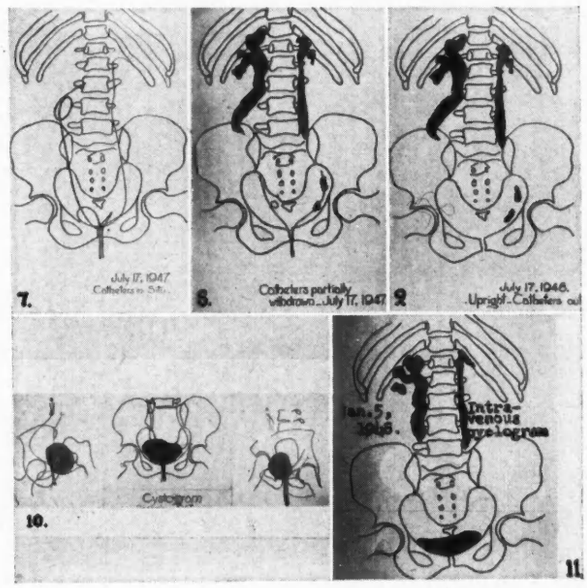
*Treatment.* — The treatment of an ectopic ureter is always surgical, the choice of the procedure used being influenced by the exact findings in each case. Ligation of the offending ureter, if uninfected, has been carried out with success in about one-half of the cases tried. Nephrectomy or heminephrectomy, along with ureterectomy if the involved kidney or segment is functionless, is the procedure of choice. Reimplantation of the offending ureter into the bladder, unless contraindicated by marked dilatation, is always worthy of consideration, if kidney function is to be preserved. A most ingenious example of conservation is reported in which an anastomosis between both pelves of a duplicated kidney, along with ligation of the aberrant ureter, was carried out. The case to be presented was treated by performing a bilateral vesico-ureterostomy.

## CASE REPORT

Mrs. M.H., aged 27, was first seen on July 10, 1947, referred from the Pre-natal Clinic, in the fifth month of her third pregnancy, with the complaint of incontinence of urine.

The patient was quite well and free from urinary symptoms until July 25, 1944, three months following a normal delivery of her first baby. At this time there was a sudden onset of acute lower abdominal pain, associated with frequency, urgency, and incontinence, which lasted three days. Recovery was complete, but only for one month. Incontinence then recurred, although the patient continued to void at regular intervals. With her second, and the present pregnancy, she noticed that the urinary leakage became more marked, and that her voidings became less frequent, with a much smaller volume of urine passed with each voiding. Admission to hospital was arranged, and, on July 17, 1947, urethroscopic and cystoscopic examinations were carried out.

Under local anæsthetic of 5% cocaine, the panendoscope was fairly easily introduced, finding clear urine in the bladder. There were four or five polypoid bodies present on the bladder neck between ten and one o'clock. A small opening, assumed at the time to be the mouth of a urethral diverticulum, was present about 3 mm. distal to the bladder neck, on the floor of the urethra, a little to the right of the midline. There was a similar opening present a little more distally on the left wall of the urethra. The cystoscope was then introduced, and a small quantity of sand was seen lying free in the bladder. The bladder mucosa was pale throughout, with no ureteral orifices visible. Indigocarmine injected intravenously failed to appear in ten minutes. It was then noted that no trigone was present, and attention was directed to the two openings previously seen in the urethra. No. 5 ureteral catheters entered these openings readily and passed well up to the kidneys, meeting no obstruction. The flow from both sides was a continuous drip of clear, very pale blue urine.




The plain plate taken at this time showed no calculi (Fig. 7); the catheters were well placed and the right one formed a broad loop opposite the fourth lumbar vertebra, indicating marked dilatation of the ureter. The pyelogram confirmed this, particularly on the right side, where marked hydronephrosis and hydroureter were present (Fig. 8). The upright plate taken five minutes later showed no drainage and no appreciable ptosis on either side (Fig. 9).

The urine obtained from the bladder, and right and left kidneys, showed only one pus cell per high power field, but all grew *B. coli* on culture. The blood chemistry was normal; the Wassermann was negative; the hæmoglobin was 73%; and white blood count 9,000.

Because of the presence of the pregnancy, a consultation was arranged with the gynæcological and obstetrical staff. They expressed the opinion that the patient should be followed in the pre-natal clinic until after her confinement, and then be readmitted for further examination and study.

The patient had a normal delivery of a healthy female infant on November 28, and returned to the Urological Outdoor Clinic on December 19, 1947. She demanded admission and stated that her incontinence had become almost unbearable. She was readmitted on December 26. During this admission a repeat cystoscopic examination was carried out. The bladder capacity was found to be

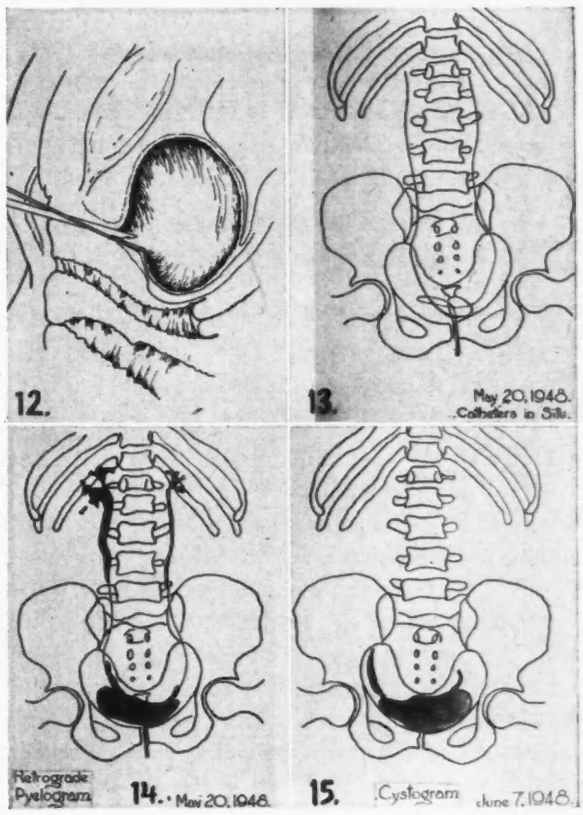
8 oz. It was also noted that, with a No. 6 ureteral catheter in each ureter and the cystoscope focused on the base of the bladder, a ripple could be seen on the bladder mucosa when the catheters were moved up and down the lower portion of the ureters. This was taken to indicate that both ureters ran for some distance under the vesical mucosa before opening on the urethral surface. A cystogram, with the urethral catheters *in situ*, was done, with antero-posterior right and left oblique views taken in an attempt to show the intramural portions of the ureters (Fig. 10). An intravenous pyelogram was done, which showed the same picture seen on the first admission when the patient was five months' pregnant, there being no decrease in the amount of ureteral dilatation almost two months after delivery (Fig. 11). A catheter specimen on this occasion was sterile on culture. Because of the marked dilatation, implantation of the ureters into the bladder was out of the question.

A consultation was again arranged with the gynæcological staff, which resulted in the expression of the opinion that the external sphincter should be repaired, the patient sterilized, and that a recheck intravenous pyelogram done in three months' time. Therefore, the patient was transferred to the gynæcological service for these procedures, which were duly carried out. Following operation, the patient was at first unable to void, then voided with difficulty, carrying up to 20 oz. of residual urine, and one week following discharge from hospital was incontinent again. Following the operation for sterilization, the patient developed an acute left pyelonephritis, which responded to sulfa medication.

The patient was readmitted to the urological service on April 19, 1948, and two days later a bilateral vesicoureterostomy was carried out.*

*Operation.* — Under spinal anæsthesia, the panendoscope was inserted into the urethra, and a Colling's knife was passed alongside it and up the right ureter for a distance of three-quarters of an inch (Fig. 12). The panendoscope was then advanced into the bladder, and the tenting caused by the Colling's knife could be seen on the floor of the bladder. An incision three-eighths of an inch in length was made. A similar procedure was carried out on the left side, but, the blade of the knife not being directed exactly at right angles to the bladder surface, the resulting cut was inadvertently made through the lateral wall of the ureter. A No. 6 ureteral catheter passed readily to the right kidney, but could not be made to enter the opening into the left ureter.

Convalescence following the above operation was normal for seven days, when some slight incontinence occurred, followed by hæmaturia. The hæmaturia progressed rapidly to clot retention, necessitating another trip to the operating room. After evacuation of the clots no active bleeding was visible. The new opening on the right side appeared fairly well healed and adequate. That on the left, apart from some jagged mucosa, appeared to have healed over and no doubt was responsible for the slight incontinence which had occurred on the seventh postoperative day. The bleeding, too, had undoubtedly come from this area of mucosa. At this time, without difficulty, a left vesicoureterostomy at a slightly lower level was accomplished. A No. 6 ureteral catheter passed readily to the left kidney pelvis, but was removed before the patient left the operating room. Convalescence following this procedure was perfectly normal; the patient voided normally and had no incontinence.




A recheck cystoscopic examination was made on May 20, 1948. The bladder urine appeared clear. The new openings were well healed and appeared adequate. No. 5 ureteral catheters passed to both kidney pelves readily, and the flow of urine from both sides was good and clear. Indigocarmine appeared in fair concentration from both sides in three minutes. The plain plate showed the catheters well placed and devoid of loops (Fig. 13). The bilateral pyelogram showed a marked regression of the hydronephrosis and hydroureter. The right and left kidney urine showed one to two pus cells per high power field, and both grew, on culture, a few Gram-positive bacilli (Fig. 14). On June 7, 1948, a cystogram was done which showed a

* Procedure used was described by Dr. J. C. McClelland, *British Journal of Urology*, **4**: 46, 1932.

fair amount of reflux up both ureters (Fig. 15). The patient at this time was symptom-free.

SUMMARY

The problem of the ectopic ureter has been presented, with a review of the embryology of the genital and lower urinary tract, in an attempt to explain the occurrence of this condition. The various methods of treatment have been outlined and a case, with bilateral ectopic ureters opening into the urethra, occurring in a 27-year old female, has been reported.

250 Main St.

## ACUTE THIAMINE DEFICIENCY: A USEFUL DIAGNOSTIC AID FOR ITS DETECTION*

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EMPHASIS has been laid in clinical and laboratory work on the effect of thiamine deficiency on carbohydrate metabolism. It is not proposed in this communication to review in detail all the past work done in this connection, but some of the conclusions may be summarized. It is postulated that in the body most, if not all, of the glucose undergoes a series of chemical reactions in its breakdown, beginning with the combination of glucose with phosphoric acid to form glucose-6-phosphate and ending with the formation of pyruvic acid. Pyruvic acid is one of the most active intermediary compounds in living cells,[1] and is closely connected with protein and fat metabolism. It may therefore, be converted into one of several compounds, and the path of further carbohydrate catabolism splits at this point.

These chemical reactions are, of necessity, all dependent on the activity of enzyme systems. In 1921, McCarrison[2] reported that a high carbohydrate diet intensified the effects of antineuritic vitamin deficiency. This relation has been verified on many subsequent occasions and particularly by the work of Evans and Lepkovsky.[35] In 1933, Passmore, Peters and Sinclair[3] showed that in thiamine deficient brain tissue *in vitro,* pyruvate was formed from lactate and concluded that thiamine was concerned with the removal of pyruvate. Peters[4] in 1936, described the biochemical lesion in thiamine deficiency as being a defect in the power to oxidize carbohydrate intermediates and being most closely related to the oxidation of pyruvic acid. Addition of minute amounts of crystalline thiamine to the tissue restored its power to remove pyruvic acid. This was the first demonstration of an *in vitro* action of a vitamin. He concluded that the vitamin was a catalyst in the combustion of carbohydrate, since both vitamin-deficient and normal tissue produced pyruvic acid, but thiamine was necessary for its disappearance.

Platt and Lu[5] in China reported that in fulminating beriberi there was an increase in pyruvic acid in the blood, urine and the cerebrospinal fluid. They felt that there was a correlation between the amount of the increase of pyruvic acid and the degree of thiamine deficiency. Shortly afterwards Lohmann and Shuster[6] demonstrated that the chemical reactions resulting in the disposal of pyruvic acid depended on the presence of an enzyme consisting of a specific protein plus an associated compound or coenzyme which was thiamine diphosphate. This defined the rôle of the vitamin more clearly. Although there appeared to be a correlation between the pyruvic acid level in the blood and the severity of the clinical manifestations of thiamine deficiency, further studies by Lu[7] showed that symptoms could not be produced by injection of pyruvic acid in large quantities. She felt that it was unlikely that the increase in pyruvate in itself was the direct cause of the symptoms but rather the result of the metabolic derangements characterizing this condition.

Since pyruvic acid is a product of intermediary carbohydrate metabolism, it is logical to follow blood pyruvate levels after the ingestion of glucose. In the normal subject the pyruvate rises slightly during such a test and returns to normal within three hours.[8] In cases of thiamine deficiency administration of glucose throws an added strain on an already inadequate system and the blood pyruvate rises to levels much higher than normal. In recent years there have been several reports on the blood pyruvate changes in instances of clinical and experimentally induced thiamine deficiency.[16 to 19, 33] It has been reported that the fasting blood pyruvate may or may not be elevated above normal but that following the ingestion of glucose the

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level rises above normal and continues to rise or remain elevated for four or more hours and then to fall very gradually. At the same time the blood sugar curve may be normal or moderately elevated.

An acute deficiency of thiamine in man may result in pathological changes in the nervous tissue or in the cardiovascular system. The resulting manifestations of the deficiency vary according to the site and severity of the lesion. On this continent the majority of such patients are found to have varying degrees of peripheral neuritis, characterized by weakness, and paræsthesiæ or sensory loss, that is, dry beriberi. In a second group mental changes are prominent (Korsakoff's syndrome) or mental changes, ocular palsies and peripheral neuritis (Wernicke's syndrome). In a third and smaller group there is major involvement of the cardiovascular system, with generalized œdema of varying degree with or without accompanying signs and symptoms of heart failure and electrocardiographic changes. This is wet beriberi or cardiac beriberi.

Since these patients rarely, if ever, suffer from a pure thiamine deficiency and since few of them die in the acute stage of the disease, the pathological changes are not well defined. In the nervous system there is degeneration of the peripheral nerves, with myelin loss in the nerve roots and degenerative changes in the long spinal tracts. In Wernicke's syndrome, lesions are said to be present in the grey matter of the brain consisting of congestion and hæmorrhage and nuclear degeneration. This is most striking in the paramedian and paraventricular nuclei of the thalamus and hypothalamus, the mammillary bodies and in the region of the 3rd, 4th and 6th cranial nerve nuclei. When the heart is affected it may be dilated, and in some cases hypertrophied. The reason for the hypertrophy is not known. Microscopically, hydropic degeneration with mild scarring and fatty infiltration are the only changes which have been described.[3,4]

The reason for the development of any particular manifestation is also unknown. It may be that there is a difference in constitutional susceptibility or it may be related to caloric intake or to the variation in deficiency of other essential factors.

The major problem in determining changes in blood pyruvate has been the difficulty in stabilizing the blood so that the pyruvate was neither formed nor broken down after the blood was withdrawn from the patient. In this connection numerous methods have been worked out[9 to 15] and modified. Latterly Long has developed a method for stabilizing the blood immediately, which has enabled tests to be carried out at intervals of as long as three weeks after its withdrawal.[15]

The investigation reported below was undertaken to determine the usefulness of blood pyruvate levels as an index of thiamine deficiency. Blood glucose and pyruvate values were determined at intervals following the ingestion or intravenous injection of glucose. Patients with a history of dietary insufficiency or showing signs suggestive of thiamine deficiency were tested as soon as possible after admission. A second test was then carried out after varying periods of treatment with thiamine or with a good diet. A comparison of the two sets of values has proved to be an essential diagnostic procedure, since the change in the pyruvate level preceded any important clinical change in most cases, and therefore served to confirm the presence of acute thiamine deficiency. This study includes patients from the wards of the Toronto General Hospital, the Toronto Western Hospital and Sunnybrook D.V.A. Hospital.

## METHODS

(*a*) Subjects were given 100 gm. glucose in 400 c.c. water with lemon juice flavouring. They were allowed to take ½ hour to drink it. If patients were too sick or were comatose 50 c.c. of 50% glucose were injected intravenously.

(*b*) Blood samples were taken at 0, ½, 1, 2, 3 hours after the ingestion of the glucose and the following procedure was used: A dry 20 c.c. syringe with a 19 or 20 gauge needle was employed. A tourniquet was applied for as short a time as possible. Subjects were warned not to clench their fists, as this causes a local increase in pyruvate concentration, due to increased breakdown of carbohydrate in that isolated part of the body. The tourniquet was released as soon as the needle was in the vein; 10 c.c. of blood was withdrawn and 5 c.c. were added to a test tube prepared for stabilizing the pyruvate level by Long's method[15] and to a test-tube containing potassium oxalate.

(*c*) *Pyruvic acid estimation.*—Pyruvic acid from Eastman Kodak Company was redistilled *in vacuo*,[20] sodium pyruvate was prepared as described by Robertson[21] and recrystallized according to the method of Peters.[22] Purity was checked by means of the bisulphite combining power.[20, 23] The sodium pyruvate was used to construct a standard curve. The estimation of the pyruvic acid concentration in blood samples was carried out as described by Friedman and Haugen (their procedure B)[13] with the exception that a Coleman spectrophotometer was used in place of an Evelyn colorimeter. It was found that standard curves remained valid for six months or more.

Results obtained by stabilizing and estimating the pyruvate in this manner were very constant. Estimations made on repeated samples of the same blood varied by less than 1% and the level remained constant for up to three weeks, providing that the test tubes were kept in a refrigerator.

(*d*) *Blood glucose.*—This estimation was carried out according to Nelson's modification of the Somogyi method.[24] By this method non-sugar reducing substances are removed and the results are therefore, 20 to 25 mgm. % lower than those obtained by the Folin-Wu method.

## RESULTS

Pyruvic acid curves, and in most cases blood sugar curves, were determined on 27 normals and on 40 patients suspected of having severe thiamine deficiency. Of this latter group sufficient biochemical evidence of the deficiency was obtained to confirm the diagnosis in 12 instances. Brief summaries of the 12 case histories follow. They include 8 who were alcoholics, 1 "food faddist", 1 with carcinoma of the stomach, as well as a history of alcoholism and 1 with long standing steatorrhœa following a gastrectomy.

In all but 2 cases (2 and 7) there were symptoms and signs of thiamine deficiency. In all there was good biochemical evidence of such a deficiency, as indicated by a high pyruvate curve before treatment and a much lower curve following from four to thirty days of varying types of treatment. Those with mental changes exhibited very slight clinical improvement during their stay in hospital: those with peripheral neuritis improved very slowly while under observation. Ocular palsies or signs of beriberi heart disease disappeared rapidly and dramatically in a few days.

### CASE 1

Female aged 35. Admitted to hospital on April 26, 1947, because of weakness and numbness of the lower extremities. As estimated from her own statement as to her dietary history she had seldom taken as much as 0.5 mgm. thiamine per day in the preceding five months. The major portion of her diet consisted of tea and toast and large quantities of port wine, beer and spirits. She had signs of a marked peripheral neuritis involving the lower extremities. She was treated with a high calorie, high vitamin diet without added vitamin preparations, with a gradual improvement in the peripheral neuritis during her stay in hospital.

### CASE 2

Male aged 48. Admitted on May 20, 1947, because of an overdose of barbiturate. During the previous three months he had subsisted almost entirely on rye whisky. In spite of this history of a grossly inadequate diet there were no clinical manifestations of vitamin deficiency. The pyruvate curves, however, demonstrated the typical "biochemical lesion" of acute thiamine deficiency. He was treated with a full hospital diet only and within a week the pyruvate curve was normal.

### CASE 3

Male aged 52. Admitted on September 17, 1947, from jail because he was unsteady on his feet and disoriented. This unsteady gait with numbness and tingling of his feet and hands had been present for some months. There was a long history, also, of alcoholism. On admission he was disoriented and had a gross memory defect for recent events with confabulation. There was weakness of dorsiflexion of the feet, poor co-ordination of both lower limbs and a moderate stocking and glove anæsthesia of the extremities. There was tenderness of the calf muscles. In this case the first test was not performed until the patient had been in hospital for three days and the biochemical lesion was not as marked as might have been expected. Treatment consisted of a high caloric diet with added brewer's yeast and thiamine. It was felt that he had an alcoholic polyneuritis and Korsakoff's syndrome. When first admitted he had signs also of congestive failure and it was considered that he might have beriberi heart disease but the dependent œdema cleared very slowly and this suggested that the cardiac manifestations were due to arterio-sclerotic heart disease, since if they had been secondary to vitamin deficiency they would have cleared quickly under treatment. During a stay of eight months in hospital the peripheral neuritis disappeared almost entirely and his memory for recent events improved moderately so that he was considered able to care for himself on discharge.

### CASE 4

Male aged 63. Admitted on January 29, 1949, because of generalized œdema, diarrhœa and weakness of the lower extremities. He had a long history of chronic alcoholism and for four months he lived on beer and an occasional sandwich and soup. A month before admission he lost all appetite for food and drank only beer. Two weeks before admission there was an onset of a watery diarrhœa, numbness of his legs and a tendency to stumble. One week before admission he suffered chills and feverishness; a chronic cough became worse and generalized œdema began to develop. On examination he was not dyspnœic; medium râles were heard over the right upper chest anteriorly. The heart rate was 120 with occasional extrasystoles. The blood pressure was 120/80. There was massive œdema of the trunk and extremities, though the skin was warm. The calf muscles were tender and ankle jerks could not be elicited. The hæmoglobin was 70%, red blood count 4 million, circulation time (arm to tongue) normal, venous pressure normal. Serum proteins 5.3 gm. % (albumin 3.3% and globulin 2.0%). An electrocardiogram showed poorly formed T waves in all leads and auricular premature beats. The patient was given a soft diet and intramuscular B complex. Within a week the œdema had subsided, the heart rate had become normal and the electrocardiogram showed normal T waves. The serum proteins rose to 6.6 gm. % (albumin 3.9%, and globulin 2.7%). The diarrhœa persisted for two weeks though in other respects he was greatly improved and on discharge he was symptom free. This was considered to be a case of beriberi heart disease.

### CASE 5

Male aged 41. Admitted February 9, 1948, because of severe anæmia. The patient, who lived alone, had for some time ingested a thiamine poor diet which was estimated to contain not more than 0.3 to 0.6 mgm. per day. He gave a history of having noticed a numbness and tingling in his legs for five to six weeks as well as numbness of the hands and a loss of appetite and swelling of the feet and ankles for two weeks. He appeared to be much older than his stated age. There was œdema of the legs to the knees, and of the hands and forearms with a thickening of the skin and vesicular eruption at the wrists. Reflexes were active though there was some loss of position sense in the lower extremities and hypoæsthesia of the skin of the feet. The hæmoglobin was 28%, red blood count 2.8 million, obviously a post-hæmorrhage anæmia although the cause of bleed-

ing was not found. On a high calorie, high vitamin diet with large doses of thiamine intramuscularly the patient had rapid relief of the signs and symptoms of thiamine deficiency without effect on the anæmia. Later there was a rapid rise of the hæmoglobin and red blood count in response to iron therapy.

### CASE 6

Female aged 32. Admitted March 6, 1948, because of gradually increasing weakness of the lower extremities and menorrhagia. It was estimated that for three months prior to admission her intake of thiamine was less than 0.5 mgm. daily. Her diet had been supplemented by large quantities of brandy, sherry and beer. On examination the liver was greatly enlarged and non-tender and there was a severe peripheral neuritis affecting the lower extremities. In hospital the bleeding stopped spontaneously. She was given a high caloric, high vitamin diet with B complex supplements with resultant general clinical improvement in the neuritis and a decrease in the size of the liver.

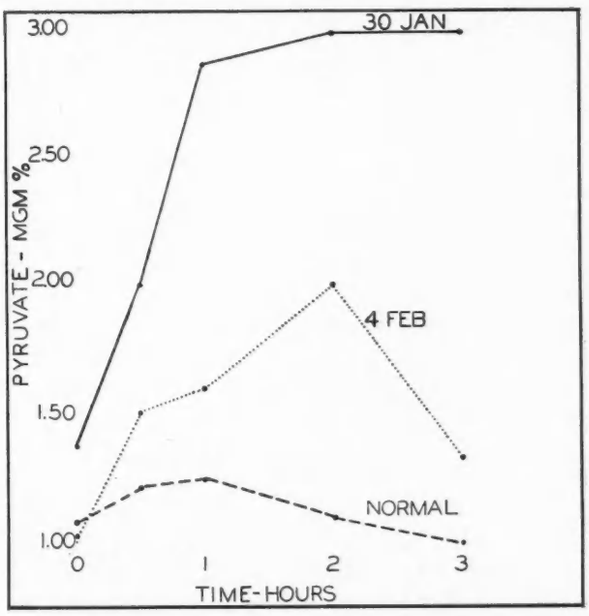


**Fig. 1.** (Case 4).—Pyruvate curve following ingestion of 100 gm. glucose (before and after thiamine therapy).

### CASE 7

Male aged 50. Admitted March 16, 1948, with a two year history suggestive of cardiac insufficiency and a longer history of chronic alcoholism and epigastric distress between meals, relieved by milk or alkali. Physical examination, apart from an emphysematous chest and moderately enlarged heart, was negative. Hæmoglobin was 50%, red blood count 2,500,000. There was occult blood in the stool. An electrocardiogram was suggestive of old myocardial infarction. A gastric series was reported as showing scarring of the duodenal caput and an active ulcer. In hospital he was treated with a gastric diet and was digitalized. The stools became free of blood and the hæmoglobin was 65%, red blood count 4 million on discharge. It is unlikely that any of his symptoms and signs were due to thiamine deficiency.

### CASE 8

Male aged 70. Admitted on March 16, 1948, because of mental confusion. Since he lived alone, no reliable history was obtainable except that he had been a chronic alcoholic. On examination he had a minimal peripheral neuritis of the lower extremities as evidenced by loss of knee and ankle jerks and moderate tenderness of the calf muscles. He also suffered from a gross memory defect with confabulation. Treatment with an ordinary ward diet plus thiamine resulted in complete disappearance of the cranial nerve paralysis, though the mental state remained unchanged. He was considered to be a case of Wernicke's syndrome.

### CASE 9

Male aged 37. This patient who is a regular attendant at the Outpatient Department had a twelve years' history of ill health. Because of a persistent duodenal ulcer a partial gastrectomy was done in 1946; severe steatorrhœa subsequently developed and he was treated with liver extract and folic acid with some improvement. The abnormal pyruvate curve was an accidental finding during a test on July 9, 1948, to determine the shape of the glucose tolerance curve. Further enquiry yielded a six months' history of increasing weakness of his legs, although in other respects he had felt better, in spite of persistent diarrhœa. Examination revealed œdema of the lower extremities to the knees, weakness of the lower extremities and absent knee and ankle jerks. Following five days' treatment with thiamine (July 18 to 23) the pyruvate curve became nearly normal. It is felt that this case of acute thiamine deficiency was the result of deranged absorption; his diet actually contained amounts of thiamine which would be abundantly adequate for healthy persons.

### CASE 10

Female aged 34. Admitted September 23, 1948. For five months she had been drinking very large amounts of beer daily with very little added food. For five weeks she had noticed increasing weakness of her legs and a sense of increasing fullness and tenderness in the upper abdomen. On examination she was found to have a rapid, regular heart rate (120) with no associated fever and no evidence of increased venous pressure. Her liver was moderately enlarged and tender. There was weakness of the lower extremities which was demonstrated to be largely hysterical, absent knee and ankle jerks and an apparent paræsthesia in both lower extremities extending upwards to the knees. There was minimal œdema over the sacrum and the shins. An electrocardiogram showed moderately low voltage, flat or inverted T-waves in the three standard leads and V 5. Following the first pyruvate curve the patient was given 20 mgm. of thiamine intramuscularly and electrocardiograms taken every few minutes showed that abnormalities in the T-waves changed toward normal after six hours. Within 24 hours T2 and T3 were upright and further changes occurred for several days. Within 24 hours the apex rate had fallen to 90. This was considered to be a case of beriberi heart disease.

### CASE 11

Male aged 64. Admitted May 21, 1949, in a state of mental confusion. A history was obtained that he had been a chronic alcoholic for many years and that for three months he had lost all appetite for food and had lived on alcoholic beverages only. On examination the heart was not enlarged and the apex rate was 100. The blood pressure was 96/58. There were bilateral basal râles. The liver was grossly enlarged and there were ecchymoses over the thighs and lower abdomen. There was dependent œdema of the back and lower extremities. Since the patient was too ill to drink, an intravenous glucose test was performed (in this test both blood glucose and pyruvate should return to the fasting level within two hours[25]). The patient died within 24 hours of admission and at autopsy was found to have a large carcinoma of the stomach with secondaries in the liver.

### CASE 12

Female aged 76. Admitted August 3, 1948, because of a one month's history of increasing cardiac insufficiency. Her story was unreliable but it was learned that for some years she had consumed large quantities of beer and wine and that the remainder of her intake

consisted in the main of tea and toast and soup with occasional small amounts of meat and vegetables. On examination she was not dyspnœic but had the other signs of cardiac insufficiency including marked dependent œdema and an enlarged heart which was fibrillating with an apex rate of 90 to 100 per minute. She was incontinent and had ecchymoses on both forearms and hands. Neurological examination was negative except that there was evidence of cerebral arteriosclerosis and a generalized hyperæsthesia of the skin. Shortly after admission digitalis and a one gram salt diet was prescribed. In this case four tests were carried out on August 6 and 30 and September 7 (following five days of thiamine therapy with 20 mgm. per day) and September 25. Only the first and last tests were indicated in the table but each succeeding test showed a progressive lowering of the pyruvate curve. The last test was essentially normal. During the first week in hospital, there was marked improvement in this patient's cardiac efficiency. She remained in hospital only because she was a problem in disposal.

## TABLES

Detailed results of tests on the thiamine deficient patients, before and after treatment, are shown in Table I. For convenience, the mean values and standard deviations of the blood pyruvates for the normal subjects and for the patients are shown in Table II. The pyruvate curves of Case 4, which are typical, are given in Fig. 1.

TABLE I.

BLOOD SUGAR AND PYRUVATE VALUES IN THIAMINE DEFICIENT PATIENTS

| | | *Blood sugar (mgm. %)* | | | | | *Blood pyruvate (mgm. %)* | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Case* | *Date* | *Fasting* | *½ hour* | *1 hour* | *2 hours* | *3 hours* | *Fasting* | *½ hour* | *1 hour* | *2 hours* | *3 hours* |
| 1 | April 26, 1947 | ... | ... | .... | ... | ... | 1.37 | 1.82 | 1.89 | 2.88 | 2.54 |
| | May 9, 1947 | ... | ... | ... | ... | ... | 0.91 | 1.05 | 1.89 | 1.69 | 1.15 |
| 2 | May 22, 1947 | ... | ... | ... | ... | ... | 1.40 | 1.90 | 1.98 | 2.03 | 1.91 |
| | May 30, 1947 | ... | ... | ... | ... | ... | 1.10 | 1.09 | 1.25 | 1.25 | 0.96 |
| 3 | Sept. 20, 1947 | ... | ... | ... | ... | ... | 1.15 | 1.40 | 1.78 | 1.85 | 1.64 |
| | Sept. 23, 1947 | ... | ... | ... | ... | ... | 1.26 | 1.29 | 1.38 | 1.30 | 1.35 |
| 4 | Jan. 30, 1948 | 102 | 126 | 162 | 198 | 110 | 1.41 | 2.02 | 2.88 | 3.00 | 3.00 |
| | Feb. 4, 1948 | 77 | 126 | 172 | 142 | 117 | 1.05 | 1.53 | 1.62 | 2.02 | 1.35 |
| 5 | Feb. 10, 1948 | 106 | 160 | 143 | 101 | 59 | 1.40 | 1.58 | 2.49 | 2.19 | 1.74 |
| | Feb. 26, 1948 | 100 | 212 | 176 | 183 | 45 | 1.20 | 1.23 | 1.73 | 1.65 | 1.53 |
| 6 | March 9, 1948 | 84 | 142 | 134 | 93 | 83 | 1.40 | 1.50 | 2.36 | 2.34 | 2.40 |
| | March 17, 1948 | 100 | 153 | 144 | 99 | 50 | 0.87 | 1.10 | 1.60 | 1.50 | 1.29 |
| 7 | March 16, 1948 | 79 | 171 | 225 | 186 | 99 | 1.48 | 1.36 | 1.92 | 2.07 | 1.78 |
| | April 10, 1948 | 90 | 137 | 208 | 174 | 109 | 1.14 | 1.46 | 1.41 | 1.04 | 1.03 |
| 8 | March 18, 1948 | 85 | 205 | 165 | 220 | 130 | 1.45 | 2.10 | 3.23 | 2.95 | 4.50 |
| | April 17, 1948 | 135 | 190 | 187 | 120 | 85 | 0.87 | 1.11 | 1.65 | 1.11 | 1.12 |
| 9 | July 9, 1948 | 66 | 100 | 116 | 109 | 87 | 1.05 | 1.11 | 1.98 | 1.80 | 2.04 |
| | July 23, 1948 | 64 | 79 | 125 | 150 | 99 | 1.04 | 1.31 | 1.35 | 1.63 | 1.25 |
| 10 | Sept. 24, 1948 | 87 | 96 | 111 | 112 | 102 | 1.65 | .... | 2.46 | 2.67 | 2.46 |
| | Oct. 3, 1948 | 74 | 135 | 119 | 107 | 78 | 0.84 | 0.99 | 1.17 | 1.25 | 1.02 |

Tests following intravenous injection of 25 grams glucose.

| | | *Fasting* | *5 mins.* | *30 mins.* | *60 mins.* | *120 mins.* | *Fasting* | *5 mins.* | *30 mins.* | *60 mins.* | *120 mins.* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 11 | May 22, 1948 | 130 | 300 | 210 | 192 | 160 | 4.35 | 4.50 | 4.90 | 4.80 | 5.10 |
| 12 | Aug. 6, 1948 | 86 | 225 | 190 | 135 | 95 | 1.50 | 1.85 | 2.18 | 2.31 | 2.27 |
| | Sept. 25, 1948 | 89 | 250 | 200 | 148 | 92 | 1.11 | 1.02 | 1.65 | 1.58 | 1.17 |

TABLE II.

MEAN BLOOD PYRUVATE VALUES IN NORMAL AND DEFICIENT CASES

| | | *Acute thiamine deficiency (10 cases)** | |
|---|---|---|---|
| *Time—hours* | *Normals (27 cases) mgm. %* | *Before treatment mgm. %* | *4 to 30 days after treatment mgm. %* |
| 0 | 1.11 ± 0.20 | 1.38 ± 0.17 | 1.03 ± 0.14 |
| ½ | 1.24 ± 0.18 | 1.64 ± 0.38 | 1.22 ± 0.18 |
| 1 | 1.27 ± 0.24 | 2.30 ± 0.46 | 1.51 ± 0.23 |
| 2 | 1.12 ± 0.17 | 2.38 ± 0.43 | 1.44 ± 0.30 |
| 3 | 1.02 ± 0.17 | 2.40 ± 0.85 | 1.21 ± 0.18 |

*Figures for cases 11 and 12 are not included since a different method of administration of glucose was used.

## DISCUSSION

It will have been noted that the majority of cases described had a long or at least an acute, alcoholic history. In addition, there was one who was in a sense a food faddist (Case 9), one who had a severe diarrhœa (Case 10), and one who, in addition to alcoholism, had loss of appetite due to far advanced malignancy (Case 11). Soma Weiss and Wilkins[26] have described the occurrence of acute thiamine deficiency in such persons as well as some who were deficient because of drug addiction or because of a medically restricted diet. The most marked example of a medically restricted diet is a long course of intravenous feedings of glucose in saline or distilled water. The common denominator in all cases is a diet which is grossly abnormal or a severe disturbance in gastrointestinal function. It is estimated that the body's stores of thiamine are exhausted after one month on a completely deficient diet. This is borne out by recent studies which demonstrate a significant reduction of the thiamine content of red blood cells after only ten days of such a diet.[32] Stores may be sufficient for a considerably longer period of a less severely restricted diet. Of course, such persons do not have a deficiency of thiamine alone and therefore all essential food factors should be utilized in the treatment.

Furthermore, it will be seen that the cases of deficiency exhibited varying disabilities. Peripheral neuritis was the most common, but mental change and gastrointestinal disorders were also seen. If the cardiovascular system was most markedly affected, tachycardia, dyspnœa, and œdema were present. For comprehensive studies of these manifestations the reader is referred to Harris,[27] Vedder,[28] Eddy and Dalldorf,[29] Strauss,[30] Williams and Spies.[31]

In the normal patient the blood pyruvate in the basal state was approximately 1.0 mgm. %. Following the glucose meal the level rose slightly for the first hour and returned to the fasting level by the end of three hours. In the thiamine deficient patients the fasting level of pyruvate tended to be slightly elevated and it rose to a much higher level during the period of the test and remained elevated. In such patients the addition of thiamine alone to the daily diet resulted in a rapid lowering of the pyruvate curve. But the curve was not completely normal nor did it revert to normal in those cases retested for as long as four weeks.

It must be emphasized that the pyruvic acid curve is a test of *acute* thiamine deficiency and will fail to demonstrate the abnormality unless it is performed as soon as possible after the patient is admitted to hospital, that is, before ingestion of thiamine containing foods. One case of classical Wernicke's syndrome was not tested for four days after admission and during that time was on an ordinary ward diet. By the time the test was performed the eye palsies had practically cleared and the biochemical lesion was no longer demonstrable.

It is also important to carry out a test before and after treatment in order to rule out the possibility that other factors have caused the abnormal curve. It is in this connection that the glucose tolerance curve is of help. If the patient is restless or feverish or has hyperthyroidism, an abnormal pyruvic acid curve may result as a reflection of increased carbohydrate metabolism. Such factors when present will also affect the glucose tolerance curve and in such cases it is not possible to interpret either of the curves as being diagnostic or suggestive of thiamine deficiency. If the blood pyruvate curve is abnormal, as described previously, before treatment is instituted and if the curve shows a marked change towards normalcy in a few days after administration of adequate amounts of thiamine, it is assumed that the patient exhibited thiamine deficiency. Although the average of the fasting levels of pyruvic acid is above normal, as pointed out by Davis and Bauer,[18] it is felt that a fasting level alone is not a sufficiently accurate indication of thiamine deficiency. Factors such as moderate exercise just prior to the test or nervousness of the patient have been found sufficient to raise the fasting level above normal, although the remainder of the curve may be normal.

## SUMMARY

During a period of eighteen months, 40 patients, who were suspected to be thiamine deficient, were examined. Of these, 20 had a history and findings which made the diagnosis more certain. In 12 of this group of 20 definite biochemical evidence was obtained to confirm the diagnosis, the evidence being derived from the interference in carbohydrate utilization caused by acute thiamine deficiency. Simultaneous pyruvic acid and glucose tolerance

curves following the ingestion or intravenous administration of glucose were used to demonstrate the biochemical lesion and a prolonged elevation of blood pyruvic acid was found to be a useful diagnostic aid.

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Everywhere in life the true question is, not what we gain, but what we do; so also in intellectual matters it is not what we receive, but what we are made to give, that chiefly contents and profits us.—Carlyle.

# BLOOD PYRUVATE CURVES OF NORMAL AND OBESE SUBJECTS FOLLOWING THE INGESTION OF CARBOHYDRATE

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NEWBURGH,[1] after reviewing the problem of obesity very completely, reached the conclusion that the marked overweight was due to an excess intake of food and not to some peculiarity in metabolism. Despite the weight of evidence behind this conclusion, it was thought that an inquiry from another point of view might be of interest. It was felt that perhaps an obese person tended to form fatty acids more quickly than do normal individuals and that a higher percentage of carbohydrate would be converted to fat. Since the synthesis of fatty acids from carbohydrates is assumed to proceed through acetate, which is a product of decarboxylation of pyruvic acid, it was considered that the blood pyruvate response to a carbohydrate meal might prove to be different in the obese. If this were the case, it might be expected that the pyruvate would not accumulate in the blood due to its rapid conversion to acetate and that the pyruvate curve following a carbohydrate meal would be flat instead of rising to a maximum in approximately one hour after the meal and returning to the fasting level in three hours.

## PROCEDURE

In this study 12 subjects of normal weight and 12 who were at least 30% overweight (as judged by comparison with weights in the Davenport table)[2] but who had no other complicating disease were fed 100 grams of glucose while in a fasting state; 5 c.c. blood samples were withdrawn at regular intervals for three hours. During this period the subjects were free to walk about but took no strenuous exercise.

The blood pyruvic acid was stabilized according to the method described by Long[3] in which the blood is added to specially prepared test-tubes. The estimations were carried out according to the method of Friedemann and Haugen[4] (Procedure B).

*Results.*—The results of pyruvate estimations in the various subjects are reported in Table I.

TABLE I.

BLOOD PYRUVATE VALUES IN NORMAL AND OBESE SUBJECTS

| Subject | Sex | Age | Height | Weight lb. | % variance from normal weight | Blood pyruvate mgm. % | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Fasting | ½ hour | 1 hour | 2 hours | 3 hours |
| Normal | | | | | | | | | | |
| T. | M. | 33 | 6′ 3″ | 180 | −6 | 0.82 | 0.90 | 1.09 | 1.11 | 0.89 |
| T | M. | | | | | 0.99 | 1.02 | 1.07 | 0.86 | 0.87 |
| McH. | M. | 50 | 5′ 6″ | 140 | −3 | 0.81 | 1.08 | 1.07 | 1.26 | 1.23 |
| McH. | M. | | | | | 1.05 | 1.37 | 1.47 | 1.47 | 1.00 |
| McV. | M. | 38 | 5′ 9″ | 152 | −3 | 0.81 | 1.13 | 1.34 | 1.14 | 0.97 |
| Be. | M. | 33 | 5′ 11″ | 157 | −6 | 1.23 | 1.11 | 0.97 | 1.05 | 1.11 |
| Be. | M. | | | | | 1.06 | 1.11 | 1.05 | 0.86 | 0.96 |
| Be. | M. | | | | | 1.31 | 1.26 | 1.39 | 1.13 | 1.17 |
| M. | M. | 28 | 5′ 8″ | 160 | +5 | 1.05 | 1.30 | 1.31 | 1.21 | 1.10 |
| R. | M. | 29 | 5′ 7″ | 145 | −2 | 1.14 | 1.26 | 1.11 | 1.20 | 0.99 |
| To. | M. | 26 | 5′ 7″ | 145 | −2 | 0.90 | 1.26 | 1.23 | 1.16 | 0.87 |
| Wi. | M. | 32 | 5′ 9″ | 145 | −7 | —— | 1.06 | 1.36 | 1.39 | 1.24 |
| Wa. | M. | 33 | 5′ 9½″ | 145 | −8 | 0.99 | 1.25 | 1.21 | 0.96 | 0.83 |
| Br. | M. | 50 | 5′ 7″ | 147 | −1 | 0.99 | 0.98 | 1.33 | 1.05 | 1.02 |
| Ba. | M. | 33 | 6′ 2″ | 180 | −4 | 0.99 | 1.26 | 1.18 | 1.06 | 0.80 |
| McL. | M. | 35 | 5′ 6″ | 130 | −10 | 1.56 | 1.16 | 1.17 | 0.90 | 1.06 |
| Obese | | | | | | | | | | |
| Sm. | F. | 15 | 5′ 6″ | 202 | +62 | 0.98 | 1.24 | 1.32 | 1.26 | 1.41 |
| D. | F. | 36 | 5′ 6″ | 229 | +66 | 0.85 | 1.28 | 1.38 | 1.05 | 1.06 |
| C. | F. | 50 | 5′ 2″ | 174 | +40 | 1.29 | 1.24 | 2.14 | 1.50 | 1.24 |
| H. | F. | 37 | 5′ 5″ | 207 | +54 | 1.48 | 1.17 | 1.17 | 1.20 | 0.98 |
| W. | F. | 13 | 5′ 2″ | 170 | +60 | 1.25 | 1.28 | 1.35 | 1.23 | 1.11 |
| F. | F. | 15 | 5′ 4″ | 204 | +71 | 1.38 | 1.04 | 1.35 | 1.41 | 1.18 |
| Hi. | F. | 15 | 5′ 6″ | 202 | +62 | 1.38 | 0.97 | 1.18 | 0.99 | 0.93 |
| D. | F. | 33 | 5′ 3″ | 169 | +33 | 1.18 | 1.14 | 1.25 | 1.23 | 1.02 |
| St. | F. | 65 | 5′ 2″ | 169 | +36 | 0.93 | 1.11 | 0.99 | 1.42 | 1.26 |
| C. | F. | 51 | 5′ 3″ | 207 | +63 | 1.05 | 1.26 | 1.84 | 1.38 | 1.11 |
| M. | M. | 15 | 5′ 10½″ | 242 | +61 | 1.17 | 1.08 | 1.41 | 1.02 | 0.91 |
| Du. | F. | 14 | 5′ 5″ | 241 | +100 | 1.05 | 1.08 | 1.22 | 1.34 | 1.34 |

For convenience the mean values and their standard deviations are as follows:

| | Normal | Obese |
|---|---|---|
| Fasting | 1.05 ± 0.18 | 1.17 ± 0.20 |
| ½ hour | 1.14 ± 0.13 | 1.16 ± 0.11 |
| 1 hour | 1.22 ± 0.14 | 1.38 ± 0.31 |
| 2 hours | 1.12 ± 0.17 | 1.25 ± 0.17 |
| 3 hours | 1.02 ± 0.15 | 1.13 ± 0.16 |

## DISCUSSION

There was no significant difference between the mean of pyruvate values for normal and obese subjects.

Data for the two groups are in moderate agreement except at the one hour level where two of the obese subjects exhibited a greater than usual response to the ingestion of carbohydrate; it should be noted that this divergence was opposite to the original hypothesis. This difference is apparent from the size of the standard deviation of the one-hour mean. Other standard deviations are sufficiently small and uniform to make it possible to conclude that results similar to those obtained with admittedly small groups of subjects would be obtained in much larger groups. The data provide no support for the hypothesis that fatty acid synthesis, at least as determined by pyruvate response after ingestion of glucose, is different in obese subjects than in normal persons. The data do indicate the soundness of Newburgh's conclusion that the cause of obesity is excess intake and not a distortion in metabolism.

## SUMMARY

The blood pyruvate levels in obese subjects after the ingestion of glucose were similar to those in normal persons. This was interpreted as evidence that carbohydrate metabolism is not abnormal in obesity.

This investigation was made possible by a grant to the Department of Public Health Nutrition by the International Health Division of the Rockefeller Foundation, for which appreciation is expressed.

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# HÆMORRHAGIC MANIFESTATIONS SECONDARY TO DICOUMAROL

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WITH the introduction of the valuable anticoagulant drug dicoumarol (3,3′ methylene-bis-[hydroxyl coumarin]) cases of overdosage with hæmorrhagic manifestations are likely to occur. This is especially true if obsolete or unreliable laboratory methods of estimating prothrombin activity are depended upon to regulate the dosage of dicoumarol, as the following case report demonstrates.

The patient, a 49-year old white male in good health, complained of a pain in the right calf on November 24, 1948. Pain was not severe but caused him to limp on walking. There was local tenderness in the calf muscles of the right leg and pain was aggravated by dorsiflexion of right foot. The following day the pain was more intense and the patient was admitted to the hospital late on the evening of November 25, 1948, with a diagnosis of phlebitis of the deep veins of the right calf.

Treatment with intravenous heparin 50 mgm. q. 4 h. and dicoumarol 100 mgm. daily was instituted and the following laboratory findings were reported.*

TABLE I.

| | *Heparin I.V. 50 mgm. q. 4 h.* | *Dosage of dicoumarol* | *Prothrombin % activity* |
|---|---|---|---|
| November 26. | 300 mgm. | 100 mgm. | 100% |
| November 27. | 300 mgm. | 100 mgm. | 100% |
| November 28. | 300 mgm. | 150 mgm. | 48% |
| November 29. | 300 mgm. | 150 mgm. | 34% |
| November 30. | | 200 mgm. | 100% |

In spite of the fact that the patient had taken a total of 500 mgm. of dicoumarol and was much improved clinically the laboratory reported a prothrombin time of 100% of normal on November 30, after a report of 34% of normal on November 29. As patient was away from home he returned to his home December 1, continuing to take dicoumarol, having prothrombin determinations done at a local hospital where the following results were reported.† (See Table II.)

Patient had been advised that the prothrombin percentage should be kept between 20 and 30% of normal or preferably even below 20%, but on only one occasion was such a value reported. By December 13 he noted numerous soft dark friable clots on his face as a result of nicking the skin while shaving, and a mild degree of bleeding from the nose and teeth occurred. He also developed constant dull aching backache across lower lumbar region, and urinalysis showed 15 to 20 red blood cells per field. Dicoumarol was discontinued, at which time the prothrombin activity was 29% of normal.

Symptoms of severe backache and recurrent bleeding continued and on December 15, the patient came under the care of Dr. Irving S. Wright who confirmed the findings and found the prothrombin time to be prolonged to 90 seconds (2% or less; normal 13 to 15 sec.).* Vitamin K (menadione) 72 mgm. was given intravenously and demerol 50 mgm. q. 4 h. for the backache. After obtaining the results of the prothrombin test hospitalization was advised.

The following day frank urinary bleeding and numerous petechial hæmorrhages on the extremities with ecchymotic skin areas under pressure points were noted.

TABLE II.

| | *Dicoumarol* | *Prothrombin % activity* |
|---|---|---|
| December 1 | 200 mgm. | |
| December 2 | 250 mgm. | 60% |
| December 3 | 300 mgm. | 60% |
| December 4 | ——— | 60% |
| December 5 | 200 mgm. | |
| December 6 | 200 mgm. | 20% |
| December 7 | 100 mgm. | |
| December 8 | 100 mgm. | 35% |
| December 9 | 200 mgm. | |
| December 10 | 100 mgm. | |
| December 11 | 200 mgm. | |
| December 12 | 100 mgm. | |
| December 13 | | 29%* |

*Urine showed 15–20 R.B.C. per field

The prothrombin time was further increased to 120 seconds. Menadione 72 mgm. was given every four hours for 5 doses. The following day the prothrombin time was reduced to 30 seconds but urinary bleeding continued for an additional three days before subsiding. Without further coagulant therapy the prothrombin time returned to 16 seconds two days later where it remained. No whole blood was given.

## DISCUSSION BY DR. IRVING S. WRIGHT†

The case reported by Dr. H. A. Cave brings to mind many aspects of anticoagulant therapy which seem worthy of discussion. It focuses our attention chiefly on the need for a correct and accurate method for prothrombin determinations. At present there are at least three methods, which if carefully carried out, are entirely satisfactory for the control of dicoumarol therapy. These are: (1) The one-stage technique of Quick;[1] (2) the two-stage technique of Warner, Brinkhaus and Smith;[2] and the Link-Shapiro[3, 4, 5] modification of the one-stage method of Quick. Appended to this discussion will be found a description of the last named method which has proved in our laboratory to be eminently satisfactory. In addition to the technique, which needs to be precise, it is vitally important that the thromboplastin used must be well standardized and accurate.

While the clinician is in a sense dependent upon the laboratory reports for correct guidance regarding the dosage of dicoumarol, his personal clinical experience and acumen may serve as additional safeguards. For example, in the first

* Modified Quick's Method. According to this method undiluted plasma should give a clotting time of 12 to 18 seconds. A typical curve for normal values is as follows: 100%, 11 1/5 sec.; 50%,13 4/5 sec.; 30%, 16 1/5 sec.; 20%, 20 2/5 sec.; 12.5%, 29 2/5 sec.; 10%, 37 sec. The thromboplastin solutions used give a control of undiluted plasma of 11 to 13 sec. (Personal communication).

† Quick's Method (Clinical Diagnosis by Laboratory Methods: Todd and Sanford).

* Link-Shapiro Modification of the Quick Test.

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table presented, it will be noted that after dicoumarol had been administered for three days, the prothrombin activity in terms of percentage was given as 34%. In spite of an additional dose of 150 mgm. of dicoumarol given on the fourth day, the prothrombin activity was reported on the fifth day as being 100%. This would be recognized by a clinician experienced in this field as being entirely unlikely and should have served as a warning that all was not well with the laboratory reports. This case also illustrates a point which we have made previously, that the reporting of the prothrombin activity in terms of percentage without the inclusion of the control reading for that particular determination in terms of seconds is potentially dangerous, because the clinician cannot determine whether the control tests for that day are satisfactory. This is the second case confirming our previous stand which has come to my attention within the last few weeks. The first case, which will be published by Col. Charles Leedham, Chief of the Medical Service of the Oliver General Hospital, resulted in pericardial hæmorrhage, with development of a cardiac tamponade of serious proportions.

The clinician should also be constantly alert for evidence of urinary tract bleeding, unusual petechial spots, or additional purpuric manifestations of any nature. The treatment of hæmorrhagic manifestations consists, as mentioned in Dr. Cave's report, of the use of synthetic vitamin K, such as menadione, hykanone, and similar preparations, in dosages of 60 to 75 mgm. or more every four hours; vitamin $K_1$ oxide in equivalent doses, or larger amounts, and/or transfusions of whole fresh blood.

The value of anticoagulant therapy in the treatment of thrombo-phlebitis, phlebo-thrombosis, coronary thrombosis, and rheumatic heart disease with multiple embolization is now established as among the most important therapeutic advances of this decade.

In many of these patients the risk of death ranges from 15 to 40% if untreated. Despite the risks of treatment which have been outlined in detail by numerous workers, this approach has produced reduction in the death and complication rates of a very striking degree. It is calculated risk therefore, such as one taken when embarking upon a surgical procedure. In the field of surgery the trend has been to insure that the surgeon is properly trained for the procedure which he is undertaking. In the field of anticoagulant therapy dealing with these serious diseases, we must insure that the workers that take the responsibility for this therapy are trained for the procedure. Inaccuracy or indifference on the part of either the laboratory or clinical members of this team may result in serious or even fatal complications. It has been conclusively demonstrated that in trained hands the risks are very slight. Leading clinics have reported deaths from hæmorrhage in the order of less than 0.01 to 0.1%. It is incumbent therefore, upon those who wish to use this modern form of therapy to make certain that the laboratory reports which they use are accurate and that they are prepared to conscientiously and meticulously direct the daily care of the patient.

### TECHNIQUE FOR PROTHROMBIN ACTIVITY DETERMINATIONS*

Most workers have used either the Quick test[1] or the Link-Shapiro modification of Quick test[3, 4, 5] for determining the plasma prothrombin. The Link-Shapiro modification of the Quick test which has been found to be satisfactory is performed in our laboratory as follows: The reagents used are: (1) 0.1 M sodium oxalate, prepared by dissolving 13.4 gm. of anhydrous, reagent grade sodium oxalate in 1,000 ml. of distilled water; (2) 0.85% sodium chloride, prepared by dissolving 8.5 gm. of reagent grade sodium chloride in 1,000 ml. of distilled water; (3) 0.025 M calcium chloride, prepared by dissolving 2.77 gm. of anhydrous, reagent grade calcium chloride in 1,000 ml. of distilled water; and (4) thromboplastin-calcium chloride mixture, prepared as follows: 2.5 ml. of 0.85% sodium chloride is added to 50 mgm. maltine thromboplastin in a small centrifuge tube. It is stirred until a uniform suspension is obtained and the suspension is then kept (with constant stirring) at 54 to 55° C. in a water bath for ten minutes. When the suspension has been cooled to 25 to 26° C., 2.5 ml. of 0.025 M calcium chloride solution is added and the mixture stirred for four minutes. After centrifugation at 1,700 r.p.m. for four minutes, the tube is removed from the centrifuge, taking care not to stir up the packed sediment, and the slightly turbid supernatant fluid is pipetted off to be used in the determination. (Note: Ampoules of thromboplastin should be stored in the icebox.)

The necessary apparatus includes: (1) A 37.5° C. constant temperature water bath (Machlett No. 84-410 metal constant temperature water bath, or A.H.T. No. 9925-A glass constant temperature water bath); (2) 100 by 12 mm. test tubes; (3) copper test tube racks (Army medical type to hold 100 by 12 mm. test tubes); (4) stopwatch; (5) Folin-Wu micro sugar pipettes (Normax), graduated to contain 0.1 and 0.2 ml.; and (6) Kahn viewer (if the Machlett No. A84-410 type water bath is used).

In performing the test, blood samples are taken by mixing 4.5 ml. blood quickly with 0.5 ml. of 0.1 M sodium oxalate. The oxalated blood is centrifuged at 1,700 r.p.m. for ten minutes and the clear plasma is transferred with a pipette to a test tube. Clotting time should be determined at once, but if stored in a refrigerator the plasma will remain stable for several hours. If prothrombin times are to be done on 12.5% diluted plasma as well as on whole plasma, such a dilution can

* As used in the Department of Medicine, Cornell University Medical College and New York Hospital.

Use of Anticoagulants in the Treatment of Heart Disease: I. S. Wright and W. T. Foley, *Am. J. Med.*, **3**: 718, 1947.

be made in another 100 by 12 mm. tube by diluting 0.1 ml. of whole plasma with 0.7 ml. of 0.85% saline. This should be mixed by tapping the lower end of the tube.

Two-tenths ml. portions of thromboplastin-calcium chloride suspension are transferred into 100 by 12 mm. test tubes with a 0.2 ml. micro blood sugar pipette and these tubes are placed in a rack along with the test tubes containing whole plasma or its dilution. The rack is then placed in a 37.5° C. constant temperature water bath. When the contents of the tubes have reached the bath temperature (usually 60 seconds), 0.1 ml. of whole or diluted plasma is transferred with a micro blood sugar pipette to a tube containing 0.2 ml. of thromboplastin-calcium chloride suspension. The plasma is quickly blown into the thromboplastin mixture while, at the same time, the stopwatch is started. The tube is tapped sharply to mix the solutions and a small nichrome wire stirrer is introduced to stir the solution at such a rate that the wire sweeps across the test tube from one side to the other two times per second. The process of stirring may take place outside of the water bath and viewed under the magnifying glass of a Kahn viewer. The end point, which is the formation of a fibrin clot, is that point at which the fibrin clot is sufficiently stable to be drawn to one side by the stirrer, thus bringing to view a clear area. The clot is usually turbid since the calcium oxalate formed upon calcifying the oxalated plasma is enmeshed in the clot. The prothrombin clotting time is the time in seconds required to form a clot; normal standards are for whole plasma, 13 to 17 seconds; for 12.5% diluted plasma, 35 to 42 seconds.

If the constant temperature water bath with glass walls is used, the clot formation can be viewed through the glass walls of the bath and a Kahn viewer is not essential. However, in our laboratory a Kahn viewer is preferred because thin clots, such as those obtained with 12.5% diluted plasma, are obtained easily and quickly.

Findings resulting from this test are reported in terms of seconds or they may be translated into per cent of prothrombin activity. The normal results with whole plasma fall within a range of from 13 to 17 seconds. Slight therapeutic effectiveness may begin in some patients at approximately 23 to 25 seconds and become increasingly active as the time is prolonged. Thirty seconds and 35 seconds are key levels in regard to dosage. We endeavour to maintain a level of between 30 and 50 seconds to get maximum therapeutic effects without toxicity. Some workers, including Barker,[6] believe that reports of these tests should be rendered in terms of percentage of prothrombin activity of normal plasma. When and if this can be standardized by the workers in this field it may be desirable, because it permits a correction for the use of thromboplastin of various strengths. At present, however, there are at least three different methods of setting up such curves in use in different institutions in this country. Therefore, reporting in percentage under these conditions may result in misinterpretation by other workers. The most correct technique uses a curve produced as the result of the dilution of normal plasma with prothrombin-free plasma so that 90, 80, etc., down to 10% solutions of normal plasma are obtained and prothrombin tests performed on these various diluted samples. A curve can thus be plotted which will indicate prothrombin times for various percentage levels of prothrombin deficiency. This is a logarithmic curve, not a straight line. For example, the first few seconds' increase in the prothrombin time indicates a great decrease in the prothrombin percentage of normal. When the deficiency becomes marked, many seconds' increase may mean a difference of only a few per cent in the concentration of prothrombin. As Barker points out, "by plotting a dilution curve as above outlined, any worker using a thromboplastin of unknown potency can determine a set of prothrombin times for that thromboplastic substance which indicate various percentages of prothrombin deficiency and, if certain prothrombin percentages are considered important levels, he can easily determine their equivalents in prothrombin times". In order to continue this it is necessary either to use only new thromboplastins which give identical results with the old, or to run relatively large samplings from so-called normals to establish a new curve with each new batch of thromboplastin.

The establishment of such a curve does not eliminate factors of error which have occurred in the prothrombin determinations and, in fact, it may actually magnify them. At present, following the technique of Russ,[7] we are using lyovac (dried plasma) prepared for this purpose as our standard control. It is used in the dilution of 12.5% against the plasma of a similar dilution and gives standard results for that dilution of approximately 35 to 40 seconds.[7, 8]

A more serious problem, pointed out above, lies in the use by certain institutions at present of straight curves. In other words, if the normal control for whole plasma is 15 seconds, and the result of the patient's test is 30 seconds, this is considered to be 50% of normal, a figure far different from that obtained on the logarithmic curve above described. A third technique which is unjustified has been found in use in certain institutions where, instead of 50%, the same figures, namely, 15% for the normal and 30% for the patient, would be interpreted as 200%. This may give rise to serious misunderstandings and at present appears to be safeguarded against by the use of reference to seconds and by standardizing the basic technique to the greatest degree possible.

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## ŒSOPHAGOGASTRIC RESECTIONS

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DURING recent years the transthoracic approach for surgical removal of lesions of the lower portions of the œsophagus and cardia of the stomach has been used with gratifying results. The resection of neoplasms in this region has been attended by a considerable relief of symptoms and prolongation of life with prospect of 5 year survival. It is a most satisfactory surgical procedure in that it permits re-establishment of the continuity of the alimentary tract.

The following three cases were treated by transthoracic resection and œsophagogastrostomy. The operative technique employed was that described by Churchill and Sweet,[1] intratracheal ether anæsthesia being employed. A Levine tube was placed in the œsophagus prior to operation. At operation the 9th rib was resected and the diaphragm was incised from its costal attachments to the œsophageal hiatus. This allowed for exploration of the area involved and easy mobilization of the stomach and lesion. No clamps were used to occlude the œsophagus; the cardiac end of the stomach was divided by use of the de Petz clamp. The proximal end of the stomach was closed and an end-to-end anastomosis of œsophagus to stomach was performed in two layers using interrupted silk sutures throughout. The stomach was sutured to the pleura so as to avoid tension at the line of anastomosis.

### CASE 1

This 67-year old male was admitted with a 5 week history of loss of appetite, loss of strength, and sensation of pressure at the lower end of the sternum on swallowing solids although liquids were swallowed without difficulty.

Physical examination revealed an evident weight loss, a liver enlarged 2 finger breadths below the costal margin, marked kyphosis; examination was otherwise essentially negative.

*Laboratory findings.*—Hgb. 80%, white blood cells 9,700. Blood chemistry was essentially normal except for a mild hypoproteinæmia (5.94 gm. %). Electrocardiogram was normal. Chest x-ray showed kyphosis, emphysema, slight shift of trachea to the right, no evidence of metastases. Barium swallow revealed an obstructive lesion at the lower end of the œsophagus and cardia of the stomach.

At operation a large tumour mass was palpated at the œsophagogastric junction; the liver was considered free from metastases. A transthoracic resection of the lower end of the œsophagus and cardia of the stomach with end-to-side anastomosis of œsophagus to stomach was performed under endotracheal anæsthesia. A blood transfusion was administered by cut-down during the operation. The postoperative course was uneventful. A Levine tube placed in the œsophagus prior to operation was removed on the 2nd postoperative day; the patient was given sterile water on the 4th postoperative day, and the oral intake was gradually increased. During the first postoperative day the patient was placed in an oxygen tent, and the tent was removed for gradually increasing intervals on subsequent days. On the 3rd postoperative day a Foley catheter used as an intercostal drain of the pleural cavity was removed. Subsequently there was some accumulation of fluid in the left hemithorax, and on the 8th postoperative day 600 c.c. of serosanguinous fluid was aspirated. The patient received intravenous fluids with amino acids to maintain a urinary output of approximately 1,500 c.c. daily. Streptomycin and penicillin were administered for one week. On the 8th postoperative day the patient was receiving an adequate oral intake so that intravenous therapy was discontinued; the patient was out of bed on the 10th postoperative day, and was discharged from hospital 3 weeks after operation eating without difficulty.

*Pathology report.*—Squamous cell carcinoma of the lower end of œsophagus with extension into adjacent stomach and with metastases to regional lymph nodes.

This patient was readmitted 4 months after discharge complaining of anorexia, epigastric pain, and weakness. There was no difficulty in swallowing. He was cachectic; supportive therapy was administered but his condition deteriorated progressively and he expired 9 days after admission.

At autopsy the estimated weight 95 lb. The œsophagus was of average calibre throughout and showed no narrowing of the lumen in the region of the anastomosis to the cardiac end of the stomach. The mucosal surface was intact. The left lower lobe of the lung was intimately adherent to the lower end of the œsophagus. The serosal surface of the stomach in the region of the spleen, pancreas, and diaphragm was involved by the tumour and adherent to these organs. Metastases were present in the posterior mediastinal lymph nodes, liver, pancreas, and spleen.

### CASE 2

This 71-year old male was admitted to hospital with a 7 month history of dysphagia, weight loss, and tarry stools. He had had a previous admission to the Mount Sinai Sanatorium for a tuberculous lesion of the left upper lobe.

Physical examination revealed an elderly male who experienced tenderness in the epigastrium on deep palpation. Examination was otherwise essentially negative.

*Laboratory findings.*—Hgb. 74%, white blood cells 6,300, sedimentation rate 50 mm. Blood chemistry was essentially normal except for a mild hypoproteinæmia

(5.8 gm. %). Chest x-ray showed evidence of old tuberculous changes in the left upper lobe. Barium swallow showed evidence of an infiltration of the cardiac portion of the stomach extending into the œsophagus.

At operation a tumour mass was felt at the œsophagogastric junction. A transthoracic resection of the lower end of the œsophagus and cardiac portion of the stomach was performed. Two small nodules were palpated in the liver; the possibility of these being metastatic was considered. The postoperative care was essentially similar to that of the previous case. On the 7th postoperative day 500 c.c. of serosanguinous fluid was aspirated which was sterile. This patient convalesced slowly; his lesion was more extensive and of longer duration than that of the previous case, his admission weight being but 93 lb. He was out of bed on the 12th postoperative day, and was discharged from hospital 5 weeks after operation eating without difficulty.

*Pathology report.*—Ulcerated adenocarcinoma at œsophagogastric junction, chronic gastritis and œsophagitis, regional lymph node metastases.

This patient was readmitted 13 months after discharge having sustained an intertrochanteric fracture of the neck of the right femur. Since discharge from hospital following operation he had been admitted to the Mount Sinai Sanatorium owing to the reactivation of a tuberculous pulmonary lesion. He had not experienced any difficulty in swallowing, and barium swallow on readmission revealed a free flow of barium into the stomach with no gross filling defects at the site on anastomosis. He died at the Mount Sinai Sanatorium 15 months after operation; autopsy was not performed.

### CASE 3

This 67-year old male was admitted with a 5 week history of epigastric distress, moderate loss of weight, and tarry stools.

Physical examination revealed a moderately well nourished male in whom epigastric tenderness was elicited on deep palpation.

*Laboratory findings.*—Hgb. 68%, white blood cells 10,100. Blood chemistry was essentially normal except for a mild hypoproteinæmia (5.7 gm. %). Electrocardiogram and chest x-ray were within normal limits. On the chest film the tumour mass was visible projecting into the lumen of the stomach, this mass contrasting sharply against the gas bubble. Barium swallow showed a tumour mass in the cardia of the stomach extending into the œsophagus.

At operation a tumour mass was palpated in the cardia of the stomach. A transthoracic resection of the lower end of the œsophagus and the cardiac portion of the stomach was performed. No metastatic nodules were felt in the liver. The preoperative and postoperative care was essentially similar to that of the previous cases. During the postoperative period the patient ran a febrile course with daily fluctuations in temperature from 101 to 103° (R) for 8 days which did not seem to respond to the streptomycin and penicillin chemotherapy. On the 8th day triple sulfa was added to the medication and the temperature promptly remitted to normalcy. The left hemithorax was aspirated on two occasions. Intravenous therapy was discontinued on the 8th postoperative day when the patient was receiving adequate oral intake. He was out of bed on the 12th postoperative day and was discharged from hospital 19 days after operation, eating without difficulty.

*Pathology report.*—Poorly differentiated, mucinous, ulcerated adenocarcinoma of cardiac end of stomach with extension into lower end of œsophagus.

This patient was relatively well for about 8 months; he then experienced difficulty in swallowing, regurgitation, and epigastric distress. He was readmitted to hospital and barium swallow revealed obstruction at the site of anastomosis. A jejunostomy was performed. He expired in hospital 2 months after admission.

At autopsy the estimated weight of this patient was 100 lb. Several centimeters proximal to the anastomosis the wall of the œsophagus was thickened and firm due to invasion by tumour; the lumen here was narrowed. The mucosal surface in this region was not ulcerated. The mediastinal nodes were markedly enlarged being extensively replaced by the tumour tissue. Metastases were also present in the liver, pancreas, spleen, and left upper lobe of the lung.

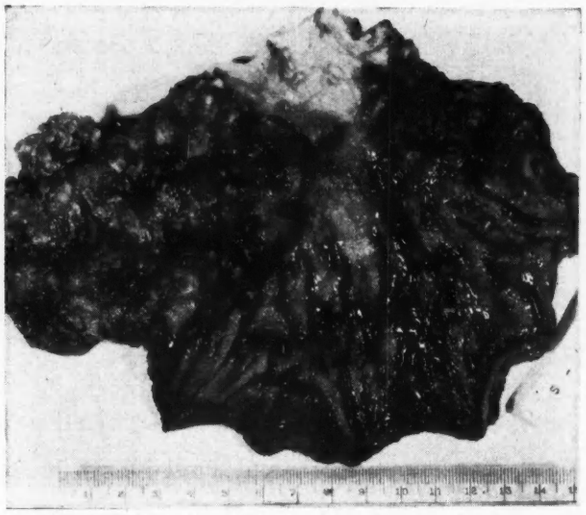

**Fig. 1.** (Case 3).—Resected specimen showing carcinoma of cardia end of stomach with extension into lower end of œsophagus.

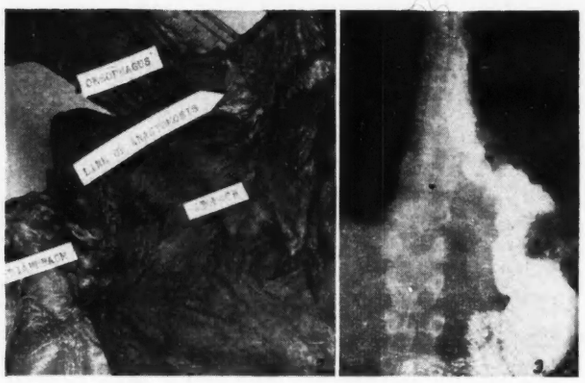

**Fig. 2.** (Case 1).—Autopsy specimen. Œsophagogastrostomy is supradiaphragmatic. **Fig. 3.** (Case 2).—Barium swallow showing free flow of barium into stomach with no gross filling defects at site of anastomosis.

### DISCUSSION

These patients, over 67 years old, tolerated the procedure well. Two of these patients had a survival period of less than one year, but the palliation offered by this operation makes the procedure justifiable. Without the operation the prognosis is hopeless and the plight of these patients unable to swallow because of obstruction is pitiable. Some of these patients suffer postoperatively from regurgitation of gastric contents and delayed emptying of stomach, but these symptoms are seldom severe. Payne and Clagett[4] report a 13% mortality in a series of 39 cases. Sweet[2] in a series of 91 cases, had a mortality of 13.2%; the mortality is higher in

the older age group. In a follow-up of their cases, Payne and Clagett[4] report that 71% survived 1 year, 40% survived 2 years, and 31% survived for 3 years. Pack and McNeer[5] feel that patients may be offered a 33% opportunity of surviving 5 years if they survive the operation. In the 91 cases reported by Sweet,[2] 39% survived 3 years. Sweet[2] failed to find any difference in survival rates between those patients with lesions in the lower end of the œsophagus and those with lesions in the cardia of the stomach.

A radical approach to these lesions should be adopted, and even if there are nodes present which cannot be resected, the removal of the neoplasm is justifiable for the palliation.

SUMMARY

Three cases of neoplasm of the œsophagogastric junction are presented. Transthoracic resection of the lesion with œsophagogastrostomy was performed in each case. The follow-up course of these patients is described. A survey of the literature reveals an immediate postoperative mortality rate of 13%; over 30% survive 3 years. The palliation offered by this operation is stressed.

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# CASE REPORTS

## CILIATED COLUMNAR EPITHELIAL CYST OF THE MEDIASTINUM

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The ciliated columnar epithelial cyst of the mediastinum is a fairly rare benign condition which has been described under various other names, *e.g.*, bronchial cyst, bronchogenic cyst, and reduplication cyst of the respiratory tract.

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Miss F.B., a 26-year old white woman, was admitted to the Victoria General Hospital in Halifax, Nova Scotia, on October 20, 1947, with a pre-admission diagnosis of "lung tumour". In the summer of 1944, the patient had a clinical attack of right-sided pleurisy and was confined to her home for 10 days. No x-ray was made at that time. From that time until July, 1947, she had a persistent, dry, non-productive cough and numerous recurrent upper respiratory infections. Also, since 1944, there was experienced in the region of, and inferior to, the right breast, a dull neuralgic-like ache, lasting not more than two or three minutes and occurring two or three times a week, uninfluenced by coughing and deep breathing, but aggravated by damp weather.

During the year previous to admission, she lost about 30 pounds in weight, had a very poor appetite, and slight dyspnœa on exertion. At no time was there hæmoptysis, night sweat, dysphagia, or cyanosis. Three months prior to admission, there was a recurrence of the clinical dry pleurisy in the right side of the chest, causing her to be confined to her home again for two weeks. X-ray of the chest at that time revealed no evidence of pleurisy, but a circumscribed mass was noted in the posterior mediastinum at the level of the ninth dorsal vertebra, and slightly to the right of the midline. There was nothing significant in the family history.

*Physical examination and laboratory findings.*—The patient was well-developed, intelligent, and co-operative, lying in bed in no apparent pain or distress. The head and neck revealed nothing abnormal other than a few carious teeth. There was no evidence of a Pancoast's syndrome. The heart was in normal position and the auscultatory findings were normal. There were no abnormal clinical findings in the lungs, abdomen, back, and extremities.

The Kahn test was negative. The hæmoglobin was 80% (Sahli) and the white cell count was 8,240 per c.mm. The sedimentation rate (Westergren) was 2 mm. The urine was normal and two samples of sputum, obtained with difficulty, failed to reveal any tubercle bacilli.

*Roentgenological studies.*—X-ray of the chest on admission showed both lung fields and diaphragms to be clear. The cardio-thoracic ratio was normal and there was no displacement of the heart. A circumscribed tumour-mass was seen in the posterior mediastinum at the level of the ninth dorsal vertebra, slightly to the right of the midline (Figs. 1 and 2). Fluoroscopic examination showed very slight displacement of the mid-portion of the œsophagus to the left. The tumour mass did not pulsate. Planograms of the chest showed a circumscribed mass lying just to the right of the midline at the level of 6 and 8 cm. from the back.

*Operation.*—On October 30, 1947, the operation was performed, the skin incision extending over the 8th right rib from a point lateral to the paravertebral muscles, to the anterior axillary line. Following partial resection of the 7th and 8th ribs, the incision was extended through the bed of the 8th rib and the parietal pleura was carefully separated from the lateral and posterior walls to expose the costo-vertebral gutter at the level of the 8th to the 10th dorsal vertebræ. An oval-shaped, tense cystic mass, approximately 10 cm. in length and 5 cm. in breadth, was visualized.

The pleura could not be freed posteriorly from the surface of the cyst, so positive pulmonary pressure was established by the anæsthetist and the pleural sac was opened over the mass, which was found to be densely adherent to the lower lobe of the right lung. The thin wall of the cyst was inadvertently opened and thick, greenish-gray, homogeneous, gelatinous material was swabbed out. The cyst was found to have several finger-like projections, all filled with the same material, running anteriorly, superiorly, and inferiorly, and with careful dissection, it was freed from the surrounding connective tissue and the medially adjacent azygos vein and vena cava. One of the fibrous strands appeared to be attached to the posterior surface of the right main bronchus, just to the right of the bifurcation of the trachea.

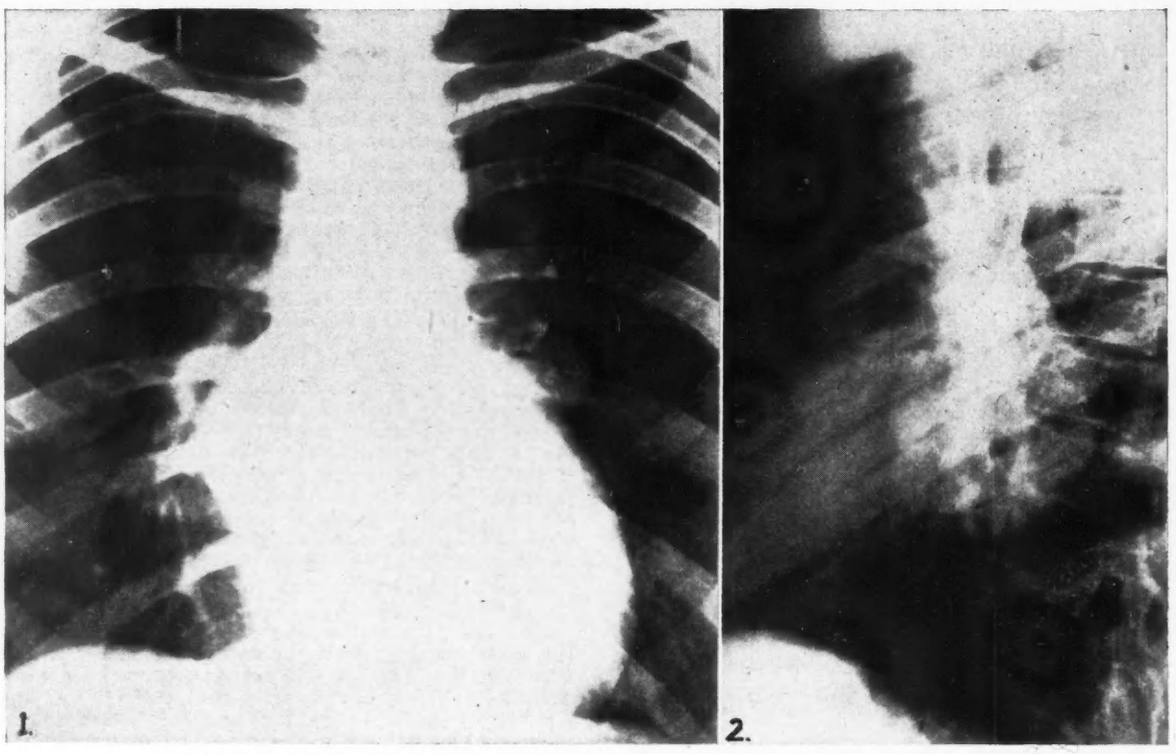


**Fig. 1.**—Antero-posterior radiograph showing the cyst extending to the right of the heart shadow at the level of the 8th, 9th and 10th ribs posteriorly. **Fig. 2.**—Lateral radiograph showing the cyst behind the heart shadow extending downwards from the hilar region.

After introducing 2.5 gm. of sulfanilamide powder into the operative bed and 100,000 units of penicillin into the pleural cavity, the pleura and wound were closed in layers, without drainage.

*Pathological examination.*—Gross examination showed a very thin-walled cyst, with a finely trabeculated lining, about the size of a small grapefruit, which had already been opened upon arrival at the pathological laboratory but some mucous material still remained in its lumen.

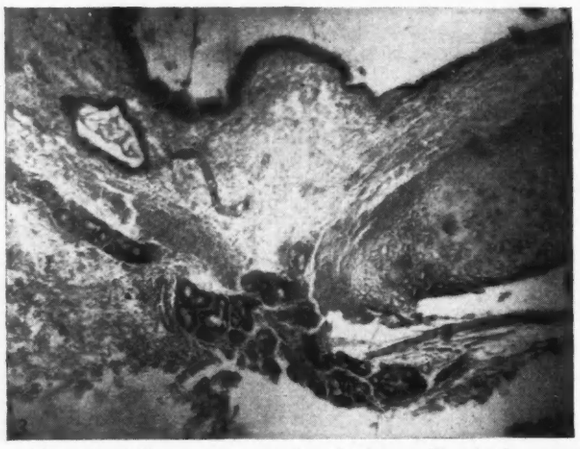

**Fig. 3.**—Micro-photograph of the wall of the cyst lined by ciliated columnar epithelium and containing hyaline cartilage and mucous glands in its wall.

Histological examination showed the cyst to be lined by pseudo-stratified ciliated columnar epithelium with fibrous tissue, cartilage, mucous glands, some fat, and distended blood vessels in its wall (Fig. 3).

*Diagnosis.*—Ciliated columnar epithelial cyst of the mediastinum.

*Progress.*—A course of penicillin was given prophylactically. Four days postoperatively, 260 c.c. of altered blood was removed from the right pleural cavity and 100,000 units of penicillin was injected. The x-ray 18 days postoperatively revealed the lung fields to be clear and the mediastinum in its normal position. The patient was discharged from the hospital on the 21st postoperative day with no complaints and 17 months later she was still in good health.

## DISCUSSION

From a review of the literature, it would appear that ciliated columnar epithelial cysts of the mediastinum occur with relative infrequency, but apparently they are not quite so rare as was once thought. Until 1938, a fairly extensive review[1] revealed that less than 20 proved cases had been reported in the English and German literature, and most of these in the latter. Between 1938 and 1944, 15 additional cases had been published,[2] bringing the total to 35. In 1946, Eerland[3] reported 1 case, and Blades[4] reviewed 23 cases treated by operation at various United States Army thoracic surgery centres over a period of 3 years. Silveus and Adams[5] cited a case in 1947 and recently another has been presented by Exalto and Waldeck.[6] Ours brings the total of reported cases to 62.

This tumour is a developmental abnormality. The theories advanced as to its origin include a pinching off of a diverticulum of entoderm and mesoderm from the foregut in the region of the tracheal bud, a secondary budding of the tracheal bud itself, and an abnormal division of the tracheobronchial tree at a later stage of development.[7] It is closely associated with the respiratory passages, usually lying near the bifurcation of the trachea on its posterior surface, in the superior part of the posterior mediastinum,[2] but it may occur in the anterior part of the superior mediastinum, or in the inferior part of the posterior mediastinum, as in our case. Usually there is no remnant of a direct communication with the trachea, although Johnston[1] states that in his case there was a small stalk of fibrous tissue, more dense than the rest of the surrounding tissue, uniting the cyst to the trachea. Chiari[8] reports a communication between the cyst and the trachea in five cases. No patent communication between the cyst and the tracheo-bronchial tree was demonstrated in any of the cases collected by Blades.[4] In our case there was a fibrous attachment to the posterior surface of the right main bronchus, but no patent communication.

The cysts vary greatly in size, from a few to several centimetres in diameter, and because of the malleability of the fluid-filled cyst, the shape varies considerably, depending on its situation in relation to neighbouring viscera. They are characteristically thin-walled structures containing thin milky-coloured fluid or greenish-gray homogeneous, gelatinous material, but they may vary greatly, sometimes being almost solid.[9] In one other case, the cyst wall broke during removal.[6]

Any of the tissues which are normally found in the wall of the trachea and bronchi may be found in the cyst wall. The epithelial lining is of pseudostratified ciliated columnar type, but in some areas the cilia and even the complete epithelial layer may be absent. Other types of tissue found include fibrous connective tissue, glands, hyaline cartilage, smooth muscle, nerve fibres, blood vessels, and elastic tissue.

*Clinical features and diagnosis.* — Symptoms due to mediastinal cysts of this type are variable. A very small cyst pressing on the air passages of an infant can produce alarming symptoms, whereas a much larger cyst, because of its situation, may cause few or no symptoms in an adult. Sixteen of the 62 cases produced no symptoms and were found at autopsy. Usually the symptoms appear during the first few months of life or the baby may be stillborn because of the cyst. Eleven of the 62 cases were discovered when the baby was under 1 year old. The commonest symptom is pain in the chest. It is of a dull, aching neuralgic type, not severe, and often substernal. In our case, it was both neuralgic and pleuritic in type. Cough is another very common symptom. It may be dry and brassy, wheezing or productive. Cyanosis is a common clinical finding in infants with this lesion, especially occurring during crying spells and at feeding times. Cyanosis and feeding difficulties were prominent features in the 7½ month old child reported by Alford, beginning 3½ months before it died from bronchopneumonia. Dysphagia is not limited to infants, as evidenced by the difficulty in swallowing experienced for several years by the 20 year old woman successfully treated by Nyst.[7] Dyspnœa on slight exertion may also occur.

The patient may complain of symptoms due to conditions which are secondary to the presence of the cyst, *e.g.*, pulmonary suppuration, atelectasis, or bronchopneumonia. Occasionally the cyst itself may become infected,[10] and unless the presence of the cyst is known, a difficult diagnostic problem will be encountered.

There are several helpful diagnostic points obtainable by roentgenograms and fluoroscopy. On lateral films, ciliated columnar epithelial cysts are usually seen in close relation to the tracheal bifurcation and not in the extreme posterior position in which most primary nerve tumours occur, and the shadow cast usually is not so dense as that of teratoid tumours.[4] Fluoroscopic examination will show whether or not the tumour pulsates, which is sometimes helpful in differentiating it from an aortic aneurysm; the cyst may be shown to move when the patient swallows, since most of these cysts are attached to the trachea. Following the administration of barium by mouth, the relation of the cyst to the œsophagus may be ascertained.

*Treatment.*—Diagnosis cannot be made without histological examination, and unless the tumour is removed, one cannot be certain that it is not of malignant variety. There is the tendency for the cysts to increase in size and produce blockage of the bronchi with subsequent

retention of secretion and bronchopneumonia. We believe that the treatment of choice is surgical removal.

SUMMARY

1. A case history of a benign ciliated columnar epithelial cyst (bronchial cyst) of the mediastinum, proved by operation and histological examination, is reported.

2. A brief review of the literature to date on this unusual condition is presented.

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# SPECIAL ARTICLE

## THE NATIONAL CANCER INSTITUTE OF CANADA AND PROFESSIONAL EDUCATION

**O. H. Warwick, M.D.**

*Executive Director, National Cancer Institute of Canada*

In 1938 the Committee on Cancer of the Canadian Medical Association produced, under the chairmanship of the late Dr. Roscoe Graham, a "Handbook on Cancer" which was distributed to 10,500 Canadian doctors.

The membership of the National Cancer Institute of Canada has given consideration during the past year as to what further action might be taken to assist practitioners in the early recognition of cancer. It is recognized that contact with Canadian practitioners in such matters can best be made with the assistance of and through co-operation with the Canadian Medical Association.

The National Cancer Institute of the U.S. Public Health Service and the American Cancer Society have within the past two years spent a great deal of time, effort and money in the preparation of monographs on cancer by site, of professional education films and sets of approximately 400 colour transparencies, in all of which the theme of the early recognition of cancer is stressed.

The Board of Directors of the National Cancer Institute of Canada, the Chairman of the Committee on Cancer of the Canadian Medical Association and the officers of the latter body have felt that the utilization of such material would be worthwhile at the present time.

In June, 1949, copies of the film, "The Problem of Early Diagnosis" were presented to the Provincial Divisions of the Canadian Medical Association, and a copy of the film with French sound track is presently being prepared for the French-speaking doctors of the Province of Quebec. An additional five films will be produced at the approximate rate of two per year. The second of the series, "Cancer of the Breast" is about ready for distribution. Medical Societies may arrange showings on application to the Divisional Secretaries.

A series of twelve monographs on the early recognition of cancer is being prepared by the American Cancer Society and these will appear at intervals of approximately three months. They are listed below:

"Head and Neck"—Dr. Hayes E. Martin, Memorial Hospital, New York City.

"Skin"—Dr. S. William Becker, University of Chicago.

"Œsophagus and Stomach"—Dr. Owen H. Wangensteen, University Hospitals, Minneapolis.

"Large Intestine and Rectum"—Dr. Thomas E. Jones, Cleveland Clinic.

"Lung"—Dr. Richard J. Overholt, Lahey Clinic, Boston.

"Breast"—Dr. Cushman D. Haagensen, Presbyterian Hospital, Columbia University.

"Female Pelvic Organs"—Dr. Herbert F. Traut, University of California Hospital.

"Genito-Urinary"—Dr. Victor Marshall, Memorial Hospital, New York City.

"Thyroid"—Dr. John Pemberton, Mayo Clinic.

"Larynx-Pharynx"—Dr. Chevalier L. Jackson, Jr., Temple University.

"Lymphomatous Diseases"—Dr. Lloyd S. Craver, Memorial Hospital, New York City.

"Soft Part Tumours"—Dr. John J. Morton, Strong Memorial Hospital, University of Rochester.

The monograph, "Cancer of the Head and Neck" was mailed to all Canadian doctors, some 13,500 in number, in September, 1949. The Canadian Medical Association has paid the costs of mailing on these monographs and the Department of National Health and Welfare has kindly undertaken the onerous task of packaging and addressing in preparation for distribution. Arrangements have been made to mail to all Canadian doctors an additional six brochures considered as being of most importance from the standpoint of frequency of occurrence. These are cancer of the skin, breast, stomach, bowel, lung, and female pelvic organs. An insert mailed with the first monograph invites requests for any or all of a group of five brochures, the last five listed above, which might be of interest to physicians. As these monographs represent authoritative references, it is hoped that they will be retained as library material by physicians.

The response of the medical profession to the distribution of this first monograph has been

most encouraging. Letters and postcards from interested physicians have been received in large numbers at the office of the National Cancer Institute. In a few instances cards requesting the additional brochures have not indicated either the name or the address of the doctor. This makes it impossible to send the material, and any physician who has reason to believe that this essential information has been omitted in his case is requested to write again to the Administrative Offices, National Cancer Institute of Canada, 280 Bloor Street West, Toronto 5.

The National Cancer Institute of Canada has been able to be of some assistance in supplying material for sets of colour transparencies presently being prepared by the American Cancer Society and depicting the earliest clinical manifestations of cancer. Sets of these, useful for lecturing and teaching purposes, will be distributed to all Provincial Divisions of the Canadian Medical Association and to universities. The photographs chosen are the best which can be found in Canada and the United States and include short descriptive clinical histories. It is anticipated that these sets will be ready for distribution within several months' time.

For the securing of such material as described the National Cancer Institute of Canada is spending $20,000.00 in this fiscal year. The source of funds for the work of the Institute—fundamental research, research fellowships, central tumour registry, professional edueation and co-ordination of provincial diagnostic and treatment programs—is, in almost equal parts, from government grants for cancer control and annual donations from the Divisions of the Canadian Cancer Society.

# CLINICAL and LABORATORY NOTES

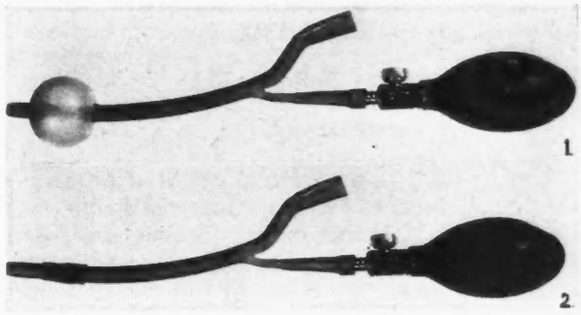
## A NEW APPARATUS FOR THE CARE OF COLOSTOMIES

**R. N. Lawson, M.D.**

*Montreal, Que.*

Efforts of medical men to standardize colostomy care usually lead to argumentation and confusion. Some doctors favour colostomy control by irrigation techniques while others condemn it, preferring to let the bowel establish its own emptying patterns. In reviewing the experiences of an appreciable number of colostomy patients, the conclusion is reached that the method of choice is best left to the individual. The irrigation method has been castigated because of the risk of bowel perforation by either the catheter or the fluid and also on the basis of the reluctance of some patients to cope with the various enema gadgets which are available. On the other hand, the ability to empty the large bowel at will is very comforting to many patients inasmuch as they may prepare both mentally and physically for activities that might otherwise be hazarded by unwanted extrusion of bowel contents. For this reason, we are generally in favour of the use of enemas.

The ordinary catheter tends to give an irrigation rather than an efficient enema. After testing a variety of trial models, we now use an improved type of balloon catheter. The illustrations (Figs. 1 and 2) depict a 7½-inch




long size 24 Fr. Bardex catheter with an open end and a large single eye in the half-inch tip. The balloon is a 30 c.c. size which has had 8 dippings for increased strength. It is inflated with air from a sphygmomanometer bulb. Three pumps uniformly inflate the balloon to the correct size. Such catheters may be obtained from C. R. Bard Inc., Summit, New Jersey. Balloons of larger size in our experience have proved dangerous.

A simple plastic (Perspex) drainage tube, (Fig. 3) weighing a few ounces, has been de-

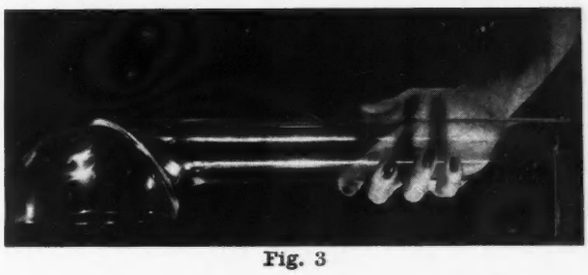


Fig. 3

signed and is used in conjunction with the catheter. This tube is funneled and permits unobstructed flow of fæcal material. After it is fastened over the colostomy (by a cord or belt encircling the body) the catheter is passed through a hole near the top and on into the bowel lumen. The catheter bag is then inflated. The enema (one or two pints warm tap water) is run in slowly and retained for a few minutes. The balloon is then deflated by opening the air valve and the catheter is removed. Fæcal material flows freely through the tube into the toilet bowl. The end of the tube rests on the bottom of the toilet and is thus practically self-supporting—an important factor in debilitated

patients. This rapid, simple and sanitary method has found immediate favour with all our patients who have tried it.*

Another aid to colostomy patients is a tablet composed of two minims of paregoric and seven and a half grains of salol.† This medication is effective in promoting constipation, decreasing the odor of the stool and is very useful in combating eating or drinking indiscretions.

37 Church Hill.

## THE "J & L" TRANSFORMER IN ENDOSCOPY

**Jean LeSage, M.D.**

*Montreal, Que.*

Until recently, a positive means of obtaining electrical power for use in endoscopy was something which was greatly desired but never accomplished. When instruments were operated with dry batteries, the power delivered was variable, depending upon the freshness of the batteries and also on how long they had been in use. Connections between the dry cells became loose, giving variable light values at the instrument bulb, and any movement of the connecting cord sometimes put the instrument out of order; just when it was most needed.

Usually, any form of chemical means of generating electrical current had certain troubles; but perhaps the greatest, after the gradual wasting away of the active chemical components, is the effect of having a higher surge of voltage just when the switch is turned on, sometimes resulting in a burned-out bulb. This is due to the voltage dropping under load as compared to the voltage being slightly higher when no current is flowing. Again, the method of raising or lowering the voltage to the bulb was cause for trouble; in that a gradual means of varying the current was not always obtainable.

With dry cell operation, usually "taps" are taken from different cells and brought out to some form of switch so that either one, two or more cells may be placed in operation, depending on how brightly the operator desires his field to be illuminated.

If it was thought desirable to operate the bulb from some higher source of direct current other than dry batteries, other problems were encountered. The higher the supply current the greater was the size of the "resistance" or "resistor box", required to cut the current down from the supply source to a means such as to not injure the instrument bulb.

It therefore became necessary to have some large form of "resistor", which, in the case of lamps became quite warm and added considerable heat to the surrounding air near the operator; or a "resistance" usually wound with wire which in turn also became quite hot. The resistor apparatus along with the actual instruments was bulky and not too easily transported.

With the above in view, consideration was given to the operation of instruments used in endoscopy from some standard source of alternating current, such as is used in any household, and which would not require heavy transportation. Alternating current has many advantages for small instrument operation. If the power supply is standard, it may be connected to practically any plug in the wall of

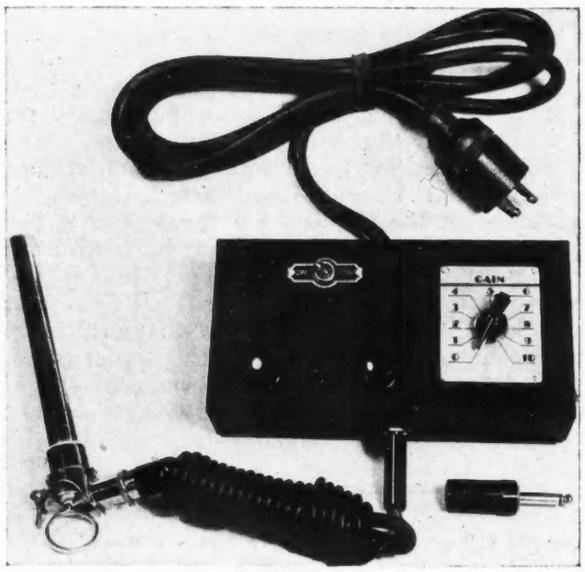



Fig. 1

any house today. Due to the power distribution from the supply companies being properly maintained, the voltage supplied to the individual house is very constant.

A most interesting fact of alternating current is that the voltage goes from nothing to full voltage in one direction, then reverses itself and goes from nothing to full voltage in the opposite direction. The number of times this condition takes place per second is termed the "frequency" or "cycles". Provided the "frequency" or "cycle" is sufficiently high, and commercially it usually is, this change in the voltage from one direction to the other cannot be noticed. The effect upon the bulb in the instrument is to give a much clearer light than with a direct current source, and with considerably less heat.

With the use of alternating current, the means to reduce the current or voltage from

* The plastic tubes are molded in one piece from a die by Neelak Products, 1029 Beaver Hall Hill, Montreal, P.Q.

† These tablets have been prepared by Frank W. Horner's Limited of Montreal, and are dispensed under the name of "Givol".

that supplied by the power company to a voltage just sufficient to operate the instrument bulb, is called a transformer, and if properly designed produces no heat. When properly connected with standard regulating apparatus, the voltage supplied to the instrument bulb is very gradually increased, with the result that the instrument bulb filament is slowly heated up, preventing a burned bulb.

By this means of slowly increasing the voltage, the bulb may be brought to a state so as to give off four to five times the light value usually obtained by other means of power supply. By means of the "gain control", an operator may obtain practically any form of illumination value within means of the ability of the bulb to stand the applied voltage.

So that a safety means is obtainable in order to prevent at any time a source of current either giving the patient or operator a shock, the transformer and its case are "grounded", that is a wire from the metal case containing the apparatus and transformer is connected to some source leading to the water pipes. Usually this is done by having a third wire in the connection cord to the house plug. Should there ever be any trouble in the winding of the transformer, the ground wire would assist in blowing the house fuse and would continue to assist in blowing the fuses until whatever fault was removed.

In a properly designed power supply for alternating current, different combinations of supply current for different voltages and frequencies or cycles are possible; that is, a transformer could be so designed as to operate off different cycles and voltages and still deliver the required voltage for the instrument bulb. It should be mentioned here, however, that the transformer as described above will not operate any form of electrical cautery which would require a means able to deliver much more current.

In conclusion, the advantages from operating endoscopic instruments from a transformer as mentioned are:

1. Four to five more times more light value is obtainable from the instrument bulb.

2. The bulb develops very little heat as compared with operation off direct current sources.

3. Injury to the mucosæ from being burned by an over heated bulb is greatly lessened.

4. The apparatus is easily transported and could be designed to operate in places where there is no commercial source of power supply, if necessary.

This apparatus was designed by Dr. R. S. Jacobs, member of the Physical Society of McGill University, with the collaboration of Dr. Jean LeSage.

For further information regarding the apparatus, consult Messrs. Racine & Co., 432 Ontario St. W., Montreal.

## Social Therapy

The following extracts are taken from the annual report of the Social Service Department of the Montreal Neurological Institute. They emphasize excellently the great significance of what is so well called social therapy.

"Helping a person to adjust to illness and its impact upon his daily living is not a simple task . . . and, to report on the contribution of social therapy to the care of the patient, we find difficult. Perhaps a recent referral will illustrate the help given a patient in the recognition of and a better acceptance of her problem.

"Dr. McEachern said to us, 'I have a patient who is complaining of severe headaches for which we have not found any organic cause. She has not responded to treatment. From her story I know her home situation is an unhappy one. Whether this is responsible for her condition, or only a factor, she cannot get the full benefit from treatment as she is. I do not know that anything can be done but I wish you would try'—and, that is what is being done. The patient while not relieved of her difficulties, is better for the joint help of doctor and social therapist and due to her greater insight into her problems, is meeting them with fewer headaches.

"Judging by the increased demands upon our department we can assume a general agreement on the part of patient, hospital and community that social therapy is an essential part of medical care. We find that our service has become more a part of the total care of the patient, that the therapist has not only interviewed and planned with the patient on his admission and discharge, but she has been used, with increasing frequency, to share in treatment where social and emotional problems were factors in the patient's illness. It is trite to repeat that medical treatment cannot be divorced from a consideration of the patient's social problems. Problems which are brought into focus by the strain and suffering of illness must often be resolved, or the patient's attitude toward them change, before treatment can be effective. Thus the social therapist has made her contribution not as separated from medical treatment but as an integral part of that treatment. Not assuming any responsibility belonging to the doctor and nurse, but as an added therapy contributing to the patient's ultimate recovery.

"But our responsibility cannot end with reporting or referring to another agency. Rather, we must point out wherein the community fails to provide facilities for our patient and indicate what can and should be done to meet his needs, be they training, employment or care. Medical science has made great advances in the care of the sick. Social provisions have not kept pace. We are beginning to recognize the interdependency, as witness the failure to provide for the chronically ill. We need factual knowledge of the social costs which are the result of disease. Such facts would confirm in human terms the need for scientific medical research and community support."

**THE CANADIAN MEDICAL ASSOCIATION**

**Editorial Offices—3640 University Street, Montreal**

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# EDITORIAL

## THE WORLD'S NARCOTIC DRUG REQUIREMENTS

THE Drug Supervisory Body appointed by the United Nations has issued its first statement on estimated world requirements of narcotic drugs for 1949. These estimates indicate the limits within which the States who are parties to the Convention (concerning manufacture and distribution of narcotics), are under obligation to restrict their manufacture and trade in drugs. It is then the function of the Permanent Central Opium Board to watch the carrying out of this obligation. At present 68 countries are parties to the Convention, and so far 64 of these have furnished estimates for 1949: of non-self-governing territories, of which there are 90, estimates have been sent in by 83. In this respect the situation is satisfactory. There is however one aspect of the world requirements of narcotics which is causing great concern, namely the high rate of consumption of diacetylmorphine (heroin) in some countries. Finland holds the unenviable, and so far unexplained, position of the highest per capita consumption of heroin in the world. In 1947 it was three times, and in 1946 four times her 1936 consumption. For 1949 the Finnish Government has submitted an estimate of gigantic proportions—197 kg., or 51 kg. per million inhabitants, as against the consumption in 1948 of 69 kg., or 17.67 per million. No other country comes even near such excessive use of heroin, although Italy, New Zealand, Sweden and Australia show great increases in consumption. In contrast, some countries have drastically reduced their consumption, notably France and Denmark: in France the consumption fell from 1.72 kg. per million in 1946 to 0.73 in 1948, and in Denmark from 4.28 in 1936 to 0.48. At the extreme end of the scale 24 countries use no heroin at all; the list includes the United States, Austria, Japan, China, Spain, Greece, Mexico, Egypt, Venezuela, etc.

As regards Canada, the per capita consumption is the 6th highest in the world with an estimate for 1949 which is a little higher than for 1948.

It is not easy to say why there should be such wide differences between countries in their consumption of heroin. In the case of Finland the Supervisory Body has made many efforts to obtain some explanation of this extraordinary phenomenon of a small country of less than 4 million people asking for a larger amount of heroin than any other country in the world, and for more than is included in the estimates of countries whose population runs into hundreds of millions. The Finnish Government however can show no justification for their demands. It cannot be a geographical factor, since Sweden, although her per capita rate is high is still many times less than that of Finland. And it is obvious from a world-wide review that the rate of consumption does not depend only on the level of medical practice, since the countries in which it is not used at all exhibit every stage of economic development.

Still it is a fact that many countries have for twenty years been able to carry on the practice of medicine without heroin at all. This is a strong argument for the proposal made as long ago as 1931 that the use of heroin should be first restricted and then abolished altogether. There has never been any general agreement in support of this, and although there have been some countries in which restriction and even abolition have been carried out, there is a definite opposition to the idea in many others.

There are possibly other factors than purely medical ones to be considered in the matter, but most medical men will probably agree that with its inherent dangers of habit formation, heroin might well be replaced by the many other available narcotics.

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History is made up of the bad actions of extraordinary men. All the most noted destroyers and deceivers of our species, all the founders of arbitrary governments and false religions, have been extraordinary men, and nine-tenths of the calamities which have befallen the human race had no other origin than the union of high intelligence with low desires.—Macaulay.

## EDITORIAL COMMENT

### National Cancer Institute of Canada

We would draw especial attention to the activities of the National Cancer Institute of Canada relating to professional education in regard to the early recognition of cancer. The National Cancer Institute have wisely chosen this as an immediate objective of extreme importance. Our own Association has paid the cost of mailing out the monograph "Cancer of the Head and Face" which has gone out to all Canadian doctors, some 13,500 in number. Further brochures on cancer are being prepared and will be distributed by degrees. The vigour and extent of this intensive effort should be productive of the most valuable results in the cancer campaign.

## MEN and BOOKS

### MEDICAL MEN AND PLACE NAMES OF BRITISH COLUMBIA

**J. H. MacDermot, M.D.**

*Vancouver, B.C.*

One of the great Canadian institutions is the Government Printing Bureau at Ottawa. Not enough is known to the average Canadian of the work of this Bureau, which has been operating for a long time now, and has published scores of unique monographs on every conceivable subject dealing with Canadian life, at a purely nominal cost. One wonders how they can do it at the price.

Do you want to know about the Birds of Canada, the Wild Flowers of Canada, the Edible Mushrooms of B.C.? Write to Ottawa, and you will get the most wonderfully illustrated books on the subject—or you used to be able to get them—the war has interfered to some extent, I believe.

Some time ago I was fortunate enough to see a remarkable book published by the Printing Bureau in 1909. It is called "British Columbia Coast Names, 1592-1906", and was written by Captain John T. Walbran of the Canadian Fisheries Service, Commanding *C.G.S. Quadra* 1891-1908. The book is the property of a bibliophile friend of mine, Dr. D. E. H. Cleveland, who lent it to me. A point of great interest about the book is that it was a presentation copy, given by the author, with a note in his own handwriting, to Admiral Lord Charles Beresford, of Alexandria fame.

Captain Walbran was in command of the *Quadra* for many years, under the Department of Marine and Fisheries of Canada. He had been interested in the matter of place names in B.C. for a very long time, and had read many papers on the subject. The Geographic Board of Canada undertook to have this book, which Captain Walbran was asked by the Minister of Marine and Fisheries to write, printed as supplementary to its own publications.

The writing of the book was for him clearly a labour of love, and he spared no time or effort to secure the fullest documentation of all his records. In his introduction to the book Captain Walbran fills three closely printed pages with acknowledgments to those who have helped him with information and loans of records. The list covers a wide range—from the authorities of the British Museum to members of Parliament—half the personnel of the British Navy, it would seem, officers of the Hudson's Bay Company, whose old ships' logs, trade books and journals were of immense value. The *Victoria Colonist*, the oldest newspaper in B.C., gave invaluable aid in the provision of old records of the Province.

The book is fascinating to read, as fascinating as a really good dictionary or encyclopædia; one is continually wandering down byways and sidepaths, irresistibly drawn aside from the narrow path of search for the particular details one wants in connection with the names and doings of medical men, which are recorded therein, and for which I was really looking. In this book one reads of massacres and Indian wars and Spanish ships and deeds of derring-do; after all it covers a period of over three hundred years, from 1592 to 1906, and much happened in that time.

He gives us a unique thumbnail history of Captain George Vancouver, who took over this area of the world from its former holders, the Spanish and who did so much exploring, and was such an eager spirit. He and the Spanish commander Quadra, from whom he took over, and after whom Walbran's ship was named, became very friendly, and Vancouver seems to have done everything in his power to soften any hurt that the proud Don might have felt. As a small instance of this, Vancouver named what is now known as Vancouver Island, "The Island of Quadra and Vancouver", with which compliment, he tells us, "Quadra seemed highly pleased".

Captain Vancouver came from King's Lynn in Norfolkshire, where he was born to John Gasper Vancouver, a man of Dutch or Flemish origin. He left many Norfolkshire names in Alaska and British Columbia, Lynn Canal being a noteworthy example.

This is all wandering rather far, however, from my subject. My reason for writing this note at all, is that as I went through this book, I was struck by the great number of names of medical men that have been perpetuated in the names given to places, seas and other bodies of water, towns and streets. This is probably

true to some extent in every province of Canada, where medical men who have been prominent in the life of their communities have been honoured by having streets, etc., named after them; but B.C. seems to have more than its share. This is partly due, no doubt, to the fact that for many years ships of the Royal Navy were the main, if not the only means of communication between Britain and the western part of Canada, especially Vancouver Island and the adjacent coast of the mainland. These ships all carried surgeons, and many of these were very able men; some were botanists, some physiologists, engineers and the like; and others took part in voyages and expeditions of discovery.

It should be remembered that what we now know as British Columbia was for a long time, at least as far as the Coast was concerned, held by the Spaniards, until the British took it over in 1792, following the Britannic-Spanish agreement of 1790. The Spaniards left indelible memories of their stay in the names of countless islands and straits — San Juan de Fuca Strait, for example, now divides Vancouver Island from the American mainland, and extends out to the Pacific Ocean; Quadra Island, Cortez Island, Hernando and many other islands, are all named after eminent Spanish sailors and administrators. Other place names are derived from Indian ethnological and etymological sources. But after the British took charge, the British Navy, as has been its way in all the seas of all the world, undertook explorations and surveys of a most extensive nature, and their ships covered the open and narrow seas of British Columbia for many years, sounding the waters, charting reefs and obstacles to safe navigation, establishing settlements, and enforcing law and order. And all their ships carried surgeons, and many of these men have left their names behind them.

Then there was the Hudson's Bay Company, with its outposts and its surgeons, of whom Dr. John McLoughlin and Dr. J. S. Helmcken were outstanding examples. Many of these men have left indelible memories of their activities in the political and business life of the country; some, through their scientific achievements and discoveries, have added to the general store of human knowledge. Such was Menzies, a famous botanist, after whom some now well known plants and trees have been named. We shall mention him more fully later on.

Some of these men were appointed as scientific experts in connection with Government expeditions. Of such was William Benjamin Carpenter, M.D., F.R.S., a noted English naturalist, born at Exeter in 1813. Some of his works became famous, *e.g.*, "Mental Physiology", published in 1874. He also published books on general physiology, comparative physiology, and human physiology. Some of these books were in general use at the turn of the century. He was a man of wide erudition, for he lectured in geology at the British Museum, and was President of the British Association for the Advancement of Science. He was naturalist in the Government expeditions sent out in *H.M.S. Lightning, Porcupine,* and *Alexander,* 1868-1871, for deep sea exploration in the Northern Atlantic, and in the *Challenger,* 1872-1876; and he contributed greatly to the knowledge that we now have of ocean circulation. His name was given to Carpenter Bay in Moresby Island, the southerly island of the Queen Charlotte Group.

Another very famous naturalist to whom we referred above, *viz.*, Archibald Menzies, surgeon and botanist, arrived in B.C. in 1792, as a member of Captain George Vancouver's expedition. He joined the expedition in England as a botanist, and later was appointed Surgeon of the *Discovery* by Vancouver, when the regular incumbent, A. P. Cranstoun, was invalided out at Nootka, B.C. An Edinburgh-trained M.D., his real avocation was botany, which he pursued at odd times during his various appointments as surgeon in ships of the Royal Navy. He was present when Admiral Rodney defeated the French fleet in 1812. Later, he was with fur expeditions trading to the B.C. coast. But, a true scientist, he always found time to devote to his botanical researches, and the well-known arbutus tree, so abundant on the west coast, was discovered and described by him. Its scientific name is *Arbutus Menziesii.* Others of the flowers that he found in such abundance in this new land, bear his name. Several places in B.C. commemorate his name—Menzies Bay, in Discovery Passage, Menzies Point on Burke Island, Menzies Street in Victoria, are all named after him, and the first two were so named by Vancouver himself, who thought highly of his surgeon.

Dr. John McLoughlin is one of the great names of British Columbia history, though he has not inspired the great amount of biographical material that have men like John Sebastian Helmcken, partly perhaps because medicine was only secondarily his occupation in this new land, and he is better known as an administrator and business executive than as a doctor. Walbran says of him "He was one of the most noted officers on this Coast in the service of the Hudson's Bay Company". He was born in 1784 at Rivière du Loup, Quebec. Educated for the medical profession in Europe, he returned to Canada, and entered the service of the Northwest Company early in the nineteenth century. In the service of this great rival of the Hudson's Bay Co., described by Lower in his "From Colony to Nation", McLoughlin showed marked capacity for business and ability to handle men, and became a trusted representative of the Company; later, when the Northwest Company amalgamated with the Hudson's Bay Company, he was promoted to be Chief Factor—was in charge at Fort

William, later at Fort George, now Astoria, in Oregon, U.S.A.

In 1824 he was moved to Fort Vancouver, which he founded. He was governing Chief Factor in charge of the Columbia territory, and became the ruling power in an immense area. Fort McLoughlin, now known as Bella Bella, was named after him. The reasons for the change of name are not known, but they hardly seem to be good ones. McLoughlin Bay, McLoughlin Point in Victoria Harbour, bear his name, also. He was a giant in build, and his mind and heart were great in proportion. To the natives he was "The White Eagle", and his word was their law.

William Fraser Tolmie was another medical officer of the Hudson's Bay Company. Born at Inverness in 1812, he was educated at Glasgow, where he received his medical degree. Botany was his favourite study. He arrived in B.C. in the spring of 1833—going first to Nisqually on Puget Sound and later to Fort McLoughlin. He was a great diarist, and his diaries were preserved by his son, Mr. John Tolmie of Victoria. They gave excellent descriptions of the country, and of the mode of life of the time. He was on the Board of Management of the Hudson's Bay Company, and later was a member of the Legislative Assembly of the Province for five years. Tolmie Channel bears his name.

John Sebastian Helmcken, M.R.C.S.(Eng.), is probably the best known medical man of early B.C. history, and certainly was a most colourful individual, the delight of biographers and the writers of historical essays, and many such have been written about him. He comes into the picture later than McLoughlin and Menzies and Tolmie. He was another contribution by the Hudson's Bay Company to the growth and development of British Columbia. He was, first and foremost, a doctor, and a very good doctor at that, devoted heart and soul to his profession, which he practised with a good deal of humour. He was a born leader, however, and like Cincinnatus of old was constantly being sought after by his country to fill positions of importance and responsibility, from which, from time to time, he escaped to return to his plough. He was born in 1825 and was with the Hudson's Bay Company as surgeon and medical officer from 1850 to 1886; during much of this time, as well as for many years thereafter, he practised in Victoria. He was at one time Speaker of the Legislative Assembly, and played a prominent part in bringing British Columbia into Confederation. Helmcken Island, in Johnstone Strait, was named after him, and an anecdote told by himself in this connection is worth recording.

"In the year 1850 I was on board the company steamer *Beaver* going to Fort Rupert, and we were passing along Johnstone Strait against a flood tide. As this island was approached, which stands in the middle of the channel, the tide rapidly increased in strength, owing to the island in the way, till the *Beaver* had extremely hard work to make any headway, the vessel sheering about in the swirling current. I asked the Captain the name of the island. . . . Captain Dodd replied 'It has no name, but I will call it after you, doctor, since it is always in opposition'. The island has since been known by my name."

Speaker Rock, Vancouver Island, is also named after him, as he was Speaker of the Legislative Assembly when it was examined in 1864 by Captain Pender. Helmcken Street in Vancouver, and Helmcken Street in Victoria, were also named after him.

Captain Vancouver gave the name of Hunter to a point on Graham Island, of the Queen Charlotte Islands. This was named after Dr. John Hunter whom Vancouver had come to know in Jamaica as superintendent of military hospitals, when Vancouver was a lieutenant in *H.M.S. Fane*. This was not *the* John Hunter, but still was a physician of high standing.

James Hutton, M.D., a noted Scottish geologist and natural philosopher, after whom Hutton Inlet in the Queen Charlotte Islands is named, was author of the "Theory of the Earth", read before the Royal Society in 1785; this came to be known as the Huttonian Theory. His name was given to the Inlet by George M. Dawson, of the Geological Survey of Canada.

Thomas Henry Huxley is better known as a biologist and scientist than as a doctor, but he was educated for the medical profession, and served in the Royal Navy. His name was given to an island in Juan Perez Sound, also by George M. Dawson.

These three men were never, as far as I know, in British Columbia, but their names honour the localities on which they were bestowed. But there were scores of men of the medical profession here from time to time, in naval and trading ships and stations, and we find their names all over the map of B.C., especially along the Coast. Among them was William Anderson, surgeon of Captain Cook's ship *Resolution*; he had a strongly scientific bent, and left many records, which the Admiralty retained after his death from tuberculosis on board the *Resolution* in the Behring Sea, August 3, 1778. Anderson Point in Nootka Sound is named after him.

Archer Point, Port Kuper, bears the name of Archibald Leslie Archer, M.D., R.N., assistant surgeon *H.M.S. Thetis*. He served during the Russian War on *H.M.S. Nile*, 1854-56.

Atkinson Island, Sutlej Channel, was named after Thomas Hall Atkinson, R.N., assistant surgeon of *H.M.S. Sutlej*, 1864-66. He was also acting surgeon on the surveying vessel *Beaver* —hence Surgeon Islet near Atkinson Island. He was later staff surgeon, and became fleet surgeon.

Septimus Evans, R.N., was surgeon of the *Beaver* 1868-70, and went through many of Her Majesty's ships of war—the list is long and imposing. He was in the *Narcissus,* flagship of Rear Admiral George G. Randolph, the *Immortalité, Topaz* and many others. His name was given to Evans Arm in Fisher Channel.

Comrie Head, Princess Royal Island, is named after Peter Comrie, R.N., surgeon on *H.M.S. Sparrowhawk.* He was the medical man who at Hesquiat, in May, 1869, examined the bodies of the shipwrecked crew of the *John Bright,* which was attacked by Indians. The Indians were tried for murder in Victoria, and Dr. Comrie was subpœnaed. (He was on the *Sparrowhawk* at the time on a cruise.) He was committed by Mr. Justice Needham for contempt of court, on failing to attend, but on his return, the judge accepted his apology for his absence, since it was necessitated by his attendance upon Governor Seymour, who died on the *Sparrowhawk* during the cruise.

Cruice Rock, Lawyer Islands, was named after William Henry Cruice, R.N., surgeon on *H.M.S. Malacca.* He was fleet surgeon in 1876, and later became Deputy Inspector of Hospitals. Bamfield Islands, Chatham Sound, bear the name of Samuel Bamfield, R.N., assistant surgeon *H.M.S. Malacca,* 1865-88, staff and fleet surgeon subsequently, and later Deputy Inspector-General of Hospitals and Fleets. Charles Bedingfield Wood, M.D., Surgeon on H.M. surveying vessel *Hecate,* 1860-62, gave his name to Wood Mountain, Clayoquot Sound, Wood Islands, in the same locality, and Wood Bay, Raymond Channel. He made an exploring trip across Vancouver Island from Kyuquot Sound to Cheslakee, Broughton Strait.

Solander Rock, off Cape Cook, keeps green the memory of a Swedish doctor and botanist, a pupil of the famous Linnaeus. Born in the early part of the eighteenth century, a graduate of the University of Upsala, he accompanied Captain Cook on the celebrated voyage of the *Endeavour.* He was Keeper of the printed books in the British Museum.

As we have recorded, the surveying vessels of Her Majesty's Navy carried surgeons, and among these was John Jolliffe, R.N., surgeon on H.M. surveying vessel *Pandora.* He seems to have been all over the world; was the sole medical officer present in the expeditions against the Malay pirates of Borneo, and was officially mentioned in the expedition against Angoza, Martinique.

One doctor's wife was the source of a place-name. Jane Island is named after Jane, the wife of John Wark, Chief Factor of the Hudson's Bay Company. Another woman, however, is commemorated by the giving of her name. Nightingale Mountain, in Queen Charlotte Sound, was named after the immortal Florence Nightingale, the great Englishwoman who was the founder of modern nursing, and left such an imperishable record of service to her fellow man.

Goodridge Islands and Goodridge Peninsula, at Sooke, Vancouver Island, were named after John Octavius Goodridge, R.N., surgeon *H.M.S. Herald,* 1846. Lyall Point, Lyall Harbour, after David Lyall, M.D., R.N., assistant surgeon H.M. surveying vessel *Plumper,* 1857-59. A famous passage on the way from Vancouver to Victoria, Plumper Pass, is named after the ship.

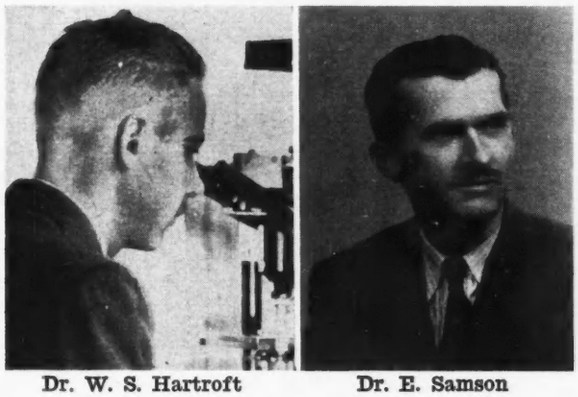
Many more names appear in the long list—and it would be merely wearisome to detail them all. Harry Point, after Harry Piers, Hanbury Point, Mosquito Pass, San Juan Island, in U.S. territory, after Ingham Hanbury, R.N., who was on duty on San Juan Island, during the joint occupancy of the Island by British and Americans: Mitchell Point, Loughborough Inlet, after John Frederick Mitchell; Douglas Harbour, Redfern Island, Turnbull Reef, Walker Point, Wallace Point, Dunns Nook—all these and many others are named after surgeons who served in various ships from the time of Captain Vancouver onwards. But enough has been said to show how these men left their mark on the country. Take Powell River for instance—named after Dr. Israel Wood Powell, M.D., Indian Commissioner 1872-79. This man was practising in Vancouver in the early part of the nineteenth century. Powell Street, one of the city's main streets, also bears his name, as does Powell River, the largest paper-manufacturing town in British Columbia, with a population of some five or six thousand people, with its own hospitals and schools and churches, and even that last proof of adulthood, a golf-course.

These were strong, capable men, doing their work well, full of the spirit of enterprise and adventure so necessary to those who are opening up a new and wild land. They commanded the respect and affection of their superiors and inferiors alike. In a new, raw country, as men of education, and belonging to a profession whose services were all too often badly needed, they readily came to the front and became leaders in their respective spheres of influence. Many of them attained high rank politically and in the educational world, as well as in the scientific zone. Tolmie and Helmcken, Menzies and McLoughlin and later McBride, were outstanding in the government of the country, and served their new homeland well. Not only in dead stones, and in points of land and in the names of rivers and seas, does their memorial lie; but in the growth of a great Province in which they took so valiant and inspiring a part; and in their contributions so made, they contributed too to the building of a greater Canada. We may justifiably be proud of these men of our own totem, and derive from their example stimulation and encouragement.

# MEDICAL SOCIETIES

## The Royal College of Physicians and Surgeons of Canada

The winners of the inaugural awards by the Royal College of Physicians and Surgeons of Canada are shown below. As already announced these are Dr. W. Stanley Hartroft, Associate Professor, Banting and Best Department of Medical Research, Toronto, and Dr. Euchariste Samson, of Quebec City. Dr. Hartroft's paper was on "Aspects of Experimental Choline Deficiency" while Dr. Samson's dealt with "Traitement Radical du Cancer de la tête du Pancreas".



Dr. W. S. Hartroft Dr. E. Samson

## Canadian Dermatological Association

The third annual meeting of the Canadian Dermatological Association was held in the Fort Garry Hotel, Winnipeg, on June 13, and 14, 1949. The following papers were presented: Endometriosis of the Umbilicus, Dr. J. F. Burgess, Montreal; Some Thoughts on Infantile Eczema, Dr. A. R. Birt, Winnipeg; Blastomycosis—a case report, Dr. C. Hair, Toronto; Investigation of Enzymes in Syphilitic Spinal Fluid, Dr. G. B. Sexton, London; Early Observation on the Use of Undecylenic Acid in the Treatment of Psoriasis, Drs. L. P. Ereaux and G. E. Craig, Montreal; Cutaneous Leishmaniasis—a case report, Dr. R. R. Forsey, Montreal.

A clinical meeting was held at Deer Lodge Hospital. The following officers were elected. *President*—Dr. G. S. Williamson, Ottawa; *Vice-President*—Dr. A. R. Birt, Winnipeg; *Secretary-Treasurer*, Dr. S. E. Grimes, Ottawa. The next meeting is planned for Quebec City in June, 1950.

## La société médicale des hôpitaux universitaires de Québec

Société médicales des hôpitaux universitaires de Québec le 4 mars, 1949.

**Considérations sur un cas de cancer du poumon.**—J.-L. Petitclerc et Giles Marceau.

Jusqu'à il y a une vingtaine d'années, deux erreurs persistaient dans le monde médical. La première était que le cancer du poumon fut une râreté alors qu'aujourd'hui, on le place comme le deuxième plus fréquent de tous les cancers; la seconde voulait que cette maladie fut mortelle alors qu'on a des survies de plus de 8% après 5 ans chez les pneumectomisés pour épithélioma bronchique. Nos connaissances plus exactes sur la nature des tumeurs pulmonaires, l'ingéniosité des moyens pour porter un diagnostic précoce et les progrès toujours grandissants de la chirurgie sont les causes de cette nouvelle conception.

Le cancer du poumon est avant tout un épithélioma bronchique typique "Epidermoid Carcinoma", Glandular Carcinoma", ou atypique "Oat-Cell Carcinoma". Le diagnostic précoce se fait par la radiographie, la bronchoscopie et la recherche des cellules cancéreuses dans les expectorations. La chirurgie consiste en la pneumectomie avec évidement ganglionnaire. Il ne faut pas craindre de faire une thoracotomie exploratrice si nécessaire. Quelques fois les premiers symptômes de la maladie sont les signes d'une métastase cérébrale. Tel est le cas chez le malade de la présentation.

Une statistique importante de 2,048 cas de cancers du poumon donne à l'aide de la chirurgie une survie après 5 ans de 8%.

**Infiltration continue du sympathique technique nouvelle.**—Bernard Paradis.

Après avoir énuméré les nombreuses maladies où le sympathique est troublé, l'auteur donne sommairement la physiopathologie de ces troubles. Il propose une infiltration localisée à la chaîne sympathique en cause. Il donne la technique ainsi que les indications de l'infiltration continue.

**Les accidents encephalopathiques chez les hypertendus.**—Sylvio LeBlond et C. Nadeau.

Ces accidents seraient le spasme artériel, la thrombose artérielle et l'hémorragie cérébrale. Cette dernière beaucoup plus rare. Les conséquences du spasme artériel et de la thrombose sont l'hémiplégie non proportionnelle, proportionelle croisée et alterne selon la topographie des lésions cérébrales en cause.

Deux hypertendus artérioscléreux de 65 ans, l'un obèse, l'autre maigre, ayant fait rous deux une hémiplégie furent traités avec hydrochlorure de papaverine et acétylcholine avec de très bons résultats. Le petit hémiplégique ne montre aujourd'hui aucune séquelle clinique d'hémiplégie et cela après trois semaines de traitement. L'autre obèse hémiplégique marche avec un peu plus de difficulté étant donné la persistance d'une certaine raideur de sa jambe droite. Cependant, il y a amélioration de pour en jour. La papavérine fut donnée tous les jours et à la dose de trois à 5 grains en même temps que ces injections I. musculaires d'acétylcholine à la dose de 0.10 c.gms. die. La médication déplétive, saignée, quelques jours après l'installation de la thrombose, le malade étant préparé la veille par 1/6 grain de morphine et 1/150 atropine avec la purgation drastique répétée, ont aidé à décongestionner nos patients. La tension artérielle chez nos deux patients était d'environ 200/130. Elle se maintient aujourd'hui avec une moyenne de 175/90 et l'albumine est disparue dans les urines.

## L'Association des pédiâtres de la province de Québec

Les pédiâtres certifiés du Collège Royal des Médecins et Chirurgiens du Canada, pratiquant dans la province de Québec, se sont constitués en corporation, sur l'invitation du Dr Paul Letondal (de Montréal), qui a pris l'initiative du mouvement. La formation de la Société, sous le nom d'Association des Pédiâtres de la Province de Québec, pour l'étude, la défense et le développement des intérêts de ses membres, a été autorisée par le Secrétaire de la Province. Le siège social de l'Association, incorporée sous la loi des syndicats professionnels, est situé à Québec.

Après avoir procédé, lors de leur première assemblée, à l'élection des principaux membres de l'Exécutif, afin de pouvoir présenter leur requête au Gouvernement Provincial, les Pédiâtres du Québec se sont réunis de nouveau, récemment, pour adopter leurs règlements et compléter leur Conseil, qui se compose comme suit: président-fondateur, le Dr Paul Letondal (de Montréal); 1er vice-président, le Dr Alton Goldbloom (de Montréal); 2e vice-président, le Dr Donat Lapointe (de Québec); secrétaire, le Dr de la Broquerie Fortier (de Québec); trésorier, le Dr Alan Ross (de Montréal);

directeurs: les Drs Albert Guilbeault (de Montréal), Edmond Potvin (de Chicoutimi), Graham Ross (de Montréal) et Roland Thibaudeau (de Québec).

### La société de pédiâtrie de Montréal

La première assemblée générale annuelle de la Société de Pédiâtrie de Montréal avait lieu, le 5 mai dernier, au Cercle Universitaire. Après la lecture des rapports résumant les travaux de l'année, l'on procéda à l'*élection des membres du Bureau pour 1949-1950*, avec les résultats suivants: président, le Dr Paul Letondal, professeur agrégé de pédiâtrie à l'Université de Montréal; vice-président, le Dr Daniel Longpré, chef du service de pédiâtrie à l'Hôpital Saint-Luc; secrétaire-trésorier, le Dr Edmond Baril, médecin de la Crèche de la Miséricorde. La Société de Pédiâtrie de Montréal groupe les pédiâtres de langue française de la métropole canadienne. Ses séances ont lieu le premier jeudi de chaque mois, sauf durant l'été. Ses compte-rendus paraissent dans le *Journal de l'Association Médicale Canadienne*. Le secrétariat est maintenant à 301, square Saint-Louis, app. 1, Montréal.

## NOTES ON GENERAL PRACTICE

[*This column will be devoted to points concerned with general practice. Questions are welcomed. They will be answered by well qualified men. Other short contributions or notes on general practice will also be welcome. General practitioners are particularly invited to make use of the column. All communications should be signed, but the writer's name will be omitted on request.*—EDITOR.]

**I would like to know whether or not there is any effective treatment for small groups of spider web type of varicose veins of the leg that are too small to inject.**—M.D.

Unless the veins in these cases are extremely small, in which case they would hardly require treatment, it is possible to inject them. Use a 26 gauge needle and inject slowly. Perhaps the best material for such injection is 1% sotradecol, which has been recently produced. This can be seen as it spreads out in the nevus. It will not cause sloughing if some gets into the tissues. Sodium morrhuate may also be used.

## CANADIAN ARMED FORCES

### News of the Medical Services

The Minister of National Defence has announced the establishment by Order-in-Council of a Defence Medical and Dental Services Advisory Board. The Board, which will act in an advisory capacity to the Minister, will carry out duties similar to those of the Canadian Medical Procurement and Assignment Board and the wartime committee on hospitalization which functioned during World War II. Surgeon Captain A. McCallum, Medical Director General, R.C.N., has been appointed Chairman of the Board. Members of the Board will be representatives from Government Departments and civil organizations interested in the various aspects of health. The Department of Labour and the Co-ordinator of Civil Defence will also be represented.

At the combined meeting of the American Society of Maxillo-Facial and Oral Surgeons, and the Canadian Society of Plastic Surgeons, held in Montreal September 12 to 17, a display of demonstration material on facial plastic surgery from the Royal Canadian Army Medical Corps Museum, was shown. The material provided those attending the meeting with an opportunity to compare the techniques and results of plastic surgery as carried out in World War I with those of World War II.

Major R. D. Barron, M.C., R.C.A.M.C., has successfully completed the 1948-49 course in public health at the School of Hygiene, University of Toronto, and has been granted a D.P.H. He is now employed as Command Hygiene Officer, Central Command.

Major M. Fitch, R.C.A.M.C., is attending the 1949-50 postgraduate course leading to a D.P.H. at the School of Hygiene, University of Toronto.

Major P. H. Bazinet is attending the 1949-50 postgraduate course in public health at the School of Hygiene, University of Montreal.

The following R.C.A.M.C. medical officers have been promoted to the rank of Major: Captain J. F. Evans, Camp Borden, Ontario; Captain R. Fournier, Camp Shilo, Manitoba; Captain R. N. Heatherington, Vancouver, B.C.

The annual meeting of the Defence Medical Association of Canada is being held at the Royal York Hotel, Toronto, on October 28 and 29 under the chairmanship of the President, Brigadier H.M. Elder, C.B.E., D.S.O., of Montreal, P.Q.

The annual conference of the Command and Area Medical Officers of the Canadian Army will take place at Army Headquarters, Ottawa, on December 15 and 16, under the presidency of the Director General of Medical Services, Brigadier W. L. Coke, O.B.E., R.C.A.M.C.

## CORRESPONDENCE

### The Tocopherols in Diabetes

To the Editor:

In the *Canadian Medical Association Journal* for September, 1949, Dr. E. H. Bensley and associates at Montreal General Hospital found the tocopherols of no value in the treatment of diabetes mellitus, in recent experimental studies.

Such an excellent report should prove that Dr. Bensley's method is ineffective. It does not however, throw any light upon other methods of demonstrating the effectiveness of vitamin E in diabetes. As the individual who first discovered the effect of oral vitamin E on hyperglycæmia[1, 2, 3] I have many letters from physicians and case histories of patients demonstrating the effectiveness of this agent when it is properly used according to my original method. This method has been described in detail, but of course not in your *Journal*. In every case I have insisted that the patient be adequately controlled, and on a proper diet before the administration of E is begun. Unless the insulin and diet are known exactly I do not understand how one can determine whether or not the medication is of any value. Dr. Bensley states specifically that only uncontrolled cases who had not been following a definite diet were used.

For another matter he did not use the alpha tocopherol product specifically indicated in my papers and which is released in the intestinal tract, but employed a product which is released in the stomach.

At the recent conference at the New York Academy of Sciences Dr. Butturini[4, 5] (who independently described the effect of intramuscular alpha tocopherol in diabetes) and myself were in complete accord as to the efficacy of this agent.

In closing I often wonder if your subscribers ever ruminate upon the complete absence of papers presenting a favourable report on E in heart disease, peripheral vascular disease, and diabetes in your *Journal* and the presence of such an article as that of Dr. Bensley. In the words of Paul—"Let everyone prove his own work".

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2. *Idem*: *J. Clin. Endocrinol.*, **8:** 883, 1948.
3. *Idem*: Vitamin E in the Treatment of Diabetes Mellitus, presented at the International Conference on Vitamin E, Section of Biology, New York Academy of Sciences, New York City, April 15 and 16, 1949.
4. BUTTURINI, U.: *Gior. di. clin. med.*, **26:** 90, 1945.
5. *Idem*: Clinical and Experimental Studies on Metabolic Inter-relationships of Vitamin E, Presented at the International Conference on Vitamin E, Section of Biology, New York Academy of Sciences, New York City, April 15 and 16, 1949.

A. VOGELSANG

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To the Editor:

I have read Dr. Vogelsang's letter of September 21 with interest. In this letter he proposes three concepts which appear to me to be rather novel and therefore deserve consideration. Since he puts forward these concepts mainly by a technique of implication, I think it worth while to set them down in unmistakable terms.

1. Vitamin E therapy is effective in the control of diabetes only when the diabetes is already adequately controlled by other means. This is a new concept, not previously stated by Dr. Vogelsang in his papers, and it is not unreasonable to expect that he will report in detail his evidence in support of it. Incidentally, the case protocols which he presents in his paper in the *Medical Record*, **161:** 363, 1948 do not support this concept and show that Dr. Vogelsang is mistaken when he states "In every case I have insisted that the patient be adequately controlled, and on a proper diet before the adminstration of E is begun".

2. The alpha-tocopherol of Natopherol Abbott and Natopherol acetate Abbott is released in the stomach, whereas that of the natural mixed tocopherols as sold by Harco Laboratories, 1186 Queen Street East, Toronto, is released in the intestine. (The latter preparation is the one now used by Dr. Vogelsang according to a personal communication from him dated April, 1949). It is suggested to Dr. Vogelsang that evidence in support of this concept might be of interest. Whatever the site of release, proof of absorption of tocopherol in our cases is furnished by the rise of plasma tocopherol during therapy. We can find no report of any studies of tocopherol absorption by Dr. Vogelsang in his cases.

3. Alpha-tocopherol released in the intestine has a favourable effect on the control of diabetes; alpha-tocopherol released in the stomach has no such effect. Again, it seems that Dr. Vogelsang might present some evidence in support of this concept.

E. H. BENSLEY

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## Trachoma

*To the Editor:*

In June of this year Dr. W. Barr Murray published "A Review of Trachoma" in your *Journal*. This paper cannot go unchallenged. It is Dr. Murray's contention that "every practitioner who has patients from all walks of life sees cases of trachoma, too often unrecognized". If he were right one would expect him to know trachoma better. Unfortunately, not only his first-hand knowledge of trachoma seems to be limited; he also seems to be insufficiently acquainted with the literature. I shall attempt to discuss briefly some of his major errors.

"It (trachoma) is common among Poles, Mongolian races and Jews throughout the world." The question of a racial disposition for trachoma is today generally answered in the negative. To quote Cuénod and Nataf in their article on trachoma in the *Traité d'Ophtalmologie* (Paris, 1939, p. 495): "Of all etiological factors accused in trachoma: race, climate, sex, age, etc. . . . there are only two which are of real importance: promiscuity on one hand, and environment on the other". If "races" are mentioned at all, surely the Arabs should not be left out who, in certain countries, show a morbidity of 100%. Amongst the Jews of Western Europe and America trachoma is unknown; and amongst the Jews in Palestine the figures for active trachoma amongst school children, *e.g.*, has dropped from 2.16% in 1919 to 0.14% in 1946 (Mirenburg, *Am. J. Ophth.*, **31:** 1289, 1948). These figures, compared with 39% for Arab school children in Palestine, and 99% in Egypt (*ibid.*) underline the supreme importance of hygienic conditions and the irrelevance of "racial susceptibility", Jews and Arabs both belonging to the semitic race.

Murray gives figures for the incidence of trachoma for a number of countries: for Poland he quotes 50%. Szymanski (*Klin, Monatsbl. f. Augenh.*, **83:** 630, 1929) estimated that about 1.5% of the population had trachoma! For Italy he gives a figure of 30%. In 1929 (Report on Hygiene of July 31, 1929) the Italian Government stated the incidence of trachoma in Army recruits to be between 3 and 6% in Southern Italy. In Northern Italy the figures are considerably lower. Greece has not 30% trachoma sufferers but, according to Copanaris (*Zentralbl. f. d. ges. Ophth.*, **27:** 717, 1932), 4.5%. For Argentina the figure is not 30% but rather 2.3% (Oynard, *Klin. Mbl. f. Augenh.*, **74:** 257, 1925). That much for Dr. Murray's statistics.

The assertion that ex-servicemen returning from overseas are liable to bring trachoma home is not documented and contradicted by the facts: not one British soldier has been found to have acquired trachoma in the Middle East where trachoma is endemic (Rycroft, *Brit. J. Ophth.*, **29:** 594, 1945).

"The earliest changes occur at the upper half of the junction of the *iris* with sclera." Even if the author had written correctly "junction of the *cornea* with the sclera" this statement would have been wrong. The earliest changes occur in the palpebral conjunctiva, the changes at the limbus being an expression of an early involvement of the corneal epithelium (Cuénod and Nataf, in *Traité d'Opht.*, **4:** p. 461).

"These (the typical inclusion bodies) were identical with Prowazek's bodies found in inclusion blennorrhœa." The inclusion bodies of trachoma actually *are* Prowazek bodies; the ones found in inclusion blennorrhœa are merely similar to them. If they were identical there would be no difference between the two diseases.

"The absence of these bodies in the early stage is proof that the examined tissue is not trachomatous." *Smears* are examined, not tissues, and the absence of inclusion bodies, the demonstration of which requires a perfect technique, should certainly not be used to exclude clinically suspected trachoma.

"The vessels (of the pannus) can be seen to be continuous with those of the sclera". This should read "with those of the conjunctiva".

"Contraction of the cicatricial tissue in the lids causes a horizontal narrowing of the palpebral fissure . . .". The formation of scar tissue in the lids causes entropion and trichiasis and, if anything, *widening* of the palpebral fissure, just through contraction. The "horizontal narrowing is called pseudo-ptosis and is "due partly to the weight of the swollen tissues and partly to myopathy of Müller's muscle" (Duke-Elder, Textbook, Vol. II, p. 1616). It is difficult to see how "paralyzed muscles" can cause *en*tropion of the lower lid. Paralysis of the muscles of the lower lid causes, of course, *ec*tropion but does not belong to the clinical picture of trachoma.

"A characteristic feature of a trachomatous corneal ulcer is that it is always located at the exact centre of the cornea." Corneal ulcers may appear anywhere on the cornea during the course of trachoma, and there is nothing characteristic about them.

"Vernal conjunctivitis can usually be identified by its occurrence in spring time." The fact is that in hot countries where it could be confused with trachoma vernal conjunctivitis tends to persist all the year round (Togby, *Giza Ophth. Lab. Rep.*, **8:** 103, 1933), and even in temperate climates the pathological changes of the palpebral conjunctiva do not disappear in winter (Duke-Elder, Textbook, Vol. II, p. 1699).

"An infected individual becomes non-infectious in three to five days of effective treatment." The fact is that we can consider ourselves fortunate if we can render a trachoma non-infectious in three to five months. In my paper with Miterstein (*The Lancet*, May 19, 1945) which the author misquotes again later on we have stated that Koch-Weeks conjunctivitis can be made non-infectious very quickly with sulfapyridine by mouth. As the trachoma virus is probably transferred with the Koch-Weeks conjunctivitis this treatment is regarded as indirectly effective in the fight against trachoma. The author seems to have thoroughly misunderstood this reasoning. He furthermore quotes us as using a combination of local treatment with an ointment containing a sulfonamide derivative, and sulfapyridine by mouth with excellent results. It is true that the results were excellent, but the author overlooked that we treated *Koch-Weeks conjunctivitis*, not trachoma, with this method.

J. J. STERN

Utica, N.Y.

## Fee-splitting

*To the Editor:*

Dr. Gallie was asked for "a kick back of 50% of the fee". He has been wise enough to include two interesting paragraphs about his earlier surgical experiences in the fee field in his Listerian Oration.[1] These were a shining light to poor men, able surgeons. Now this idealism was next watered down in a recent editorial,[2] which employed less stinging language, such as 'composite fee', etc.

Finally the shattering truth has burst upon us, duly sanctioned by authority[3] that 33 1/3% *plus an assistant's fee,* (the italics are mine) are the just deserts of the referring doctor.

It is submitted that the operation alone is often a small stage in the adequate care from first to last of a surgical case in hospital; and further that more intellect, training and good judgment may be needed before and after cutting than during this short operative period. How can a surgeon worthy of the name leave these things to a deputy? What is the opinion of the American College of Surgeons regarding ruling[3] below?

It is with regret that one sees such a ruling appear above the signature of a respected Professor of one's own school.

J. A. M. CAMERON

2 Medarts, Calgary.

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## Proposal to Film Osler

A suggestion has been received from Dr. L. Carlyle Lyon of London, England, that a film of the life of Sir William Osler should be made. He suggests that a committee from each of the universities and hospitals with which he was associated could be formed to supervise the script, and that the proceeds of the film should be devoted to the cause of helping the aged in Toronto, Montreal, Philadelphia, Baltimore and Oxford, through some appropriate organization. He draws attention to Osler's interest and care for the inmates of the Ewelme Almshouses in Oxford. He also reminds us that the French have recently made a film of Laennec.

# SPECIAL CORRESPONDENCE

## The London Letter

*(From our own correspondent)*

THE FIRST YEAR

Much interest has been evinced in a special number of *The Practitioner* which has just been published under the title of "The National Health Service Act in Great Britain". This consists of a review of the first year's working of the Act. It is the first authoritative review of the Service by active members of the medical profession that has so far been published. As such it provides a welcome practical review of the Service in action, in contrast to the mass of political propaganda on the subject with which the public has been inundated for so long. All important aspects of medical practice are covered, the contributors including a physician, a surgeon, an obstetrician, town and country general practitioners, an ophthalmologist, a dentist, a medical administrator, and so forth. The general consensus is that, in spite of all the difficulties, most of them attributable to the unseemly haste with which the Service was introduced, the Service has survived its first stormy year of existence with considerable success. Although the health of the nation has not appreciably benefited, there is no evidence that it has deteriorated. General practitioners are overworked and underpaid, but are still hopeful that their lot will be ameliorated. The maternity service is cogently criticized by the obstetrician, and the ophthalmologist and the dentist confirm the already too well known story of the unprecedented rush for spectacles and dentures. The review concludes with a critical analysis of the finances of the scheme by a member of the editorial staff of *The Economist*.

OVERWORKED DENTISTS

An interesting insight into the conditions under which dentists are working is provided by the recently published report of the working party appointed by the Ministry of Health to survey the chairside times taken in carrying out treatment by general dental practitioners. It is concluded that "most dentists are working longer hours than is comfortable, or would be good for them if continued for too long a period. . . . As a body, they have been trying to cope with the difficult task of keeping pace with demand without loss of efficiency and, as a body, the working party thinks they should have received more gratitude and less adverse criticism than has actually been the case". Of a random sample of dentists, whose conditions of work were specially investigated, it is said that there is "clear evidence" that the majority "are working at a pace which is punishing".

STUDENTS AND THEIR FOOD

From the medical aspect, perhaps the most interesting of the discussions at the meetings of the British Association last month was that in the physiology section on nutrition. Dr. R. Passmore gave details of a dietary survey carried out on students of Edinburgh University. Many of his audience were surprised to learn that the age-old tradition still persists in this University and that some students still celebrate the mid-term holiday, "Meal Monday", by returning to their croft to bring back their bag of oatmeal. Dr. Passmore was of the opinion that lack of elementary knowledge of human physiology was more important than lack of money in determining bad feeding. The landladies of Edinburgh came well out of the survey, as the majority were found to feed their student lodgers well, and the inefficient landlady was no more common than the inefficient mother. An interesting commentary on the times was the observation that food no longer served as a background for that essential function of a university—the exchange of ideas. The daily calorie intake varied considerably: from 2,000 to 4,500 calories. Ten per cent of students ate

less than 3 ounces of fresh fruit and vegetables daily. Pointing out that a considerable proportion of undergraduates are still growing, a plea was made for the university to provide an adequate midday meal for all non-resident students.

WHOOPING COUGH VACCINE

The value of pertussis vaccine in the prophylaxis of whooping cough is still under debate in this country. A preliminary report, however, just published by the Medical Research Council, suggests that opinion over here is veering round in its favour. As a result of seven trials involving a total of 4,691 test and control children, it is stated that in six of the trials the incidence and severity of whooping-cough in the test groups were less than in the control groups. Although considerable variation was found in the prophylactic potency of vaccines from different sources, it was noted that one particular type of vaccine was found to give "decidedly better" protection than the others. Unfortunately this vaccine was not readily available at present, but there would appear to be no good reason why steps should not be taken to obtain ample supplies of it for the further trials that are already under way.

WILLIAM A. R. THOMSON

London, October, 1949.

# ABSTRACTS FROM CURRENT LITERATURE

## Medicine

**Therapeutic Possibilities of Para-amino-benzoic Acid.** Zarafonetis, C. J. D.: *Ann. Int. Med.*, **30:** 1188, 1949.

The first important clinical use of PABA followed demonstration of its value in the treatment of several of the rickettsial diseases. More recent investigation has shown encouraging results in a number of diverse conditions of unknown etiology, and indicates that further investigation is justified. These include several dermatological conditions: lymphoblastoma cutis, certain forms of lupus erythematosus, active dermatomyositis, scleroderma and dermatitis herpetiformis. PABA has also been observed to be capable of producing a striking fall in the leukocyte counts in patients with chronic myelogenous leukæmia. The drug is best tolerated as a neutral salt, and in the Department of Internal Medicine, University of Michigan, it was given as 10% solution of the sodium salt (NaPAB), in doses of 10 to 40 c.c. (1 to 4 gm.) at intervals of 2 to 3 hours in some drink such as milk, fruit juice or ginger ale. PABA is rapidly excreted in the urine and the optimal dosages have not yet been determined for the various clinical conditions for which it has been used.

In leukæmia the effect in lowering the leukocyte count could be maintained only through continued administration of large amounts of PABA, while clinical improvement was slight and temporary. The author does not consider therefore that it is of practical value in leukæmia. In lymphoblastoma cutis 6 patients treated experienced relief from pruritus and objective improvement of the skin. Treatment was discontinued because of the development of œdema with the sodium salt, but in two cases where the potassium salt was given this did not occur. Thirty-three cases of lupus erythematosus were treated. The best results appeared to have been obtained in the chronic and subacute disseminated types, while only one of the 6 acute disseminated cases showed results which were in any degree encouraging. It was noted that the incidence of unfavourable reactions was higher in lupus erythematosus than in other diseases. In dermatomyositis 4 cases of 5 treated showed improvement. One case which responded dramatically was alive and active after being maintained for 18 months on KPAB.

Another "diffuse collagen disorder", scleroderma, was treated in 5 cases with good results in all. The author's observations led him to the view that the wall of the intestinal tract softened under treatment, as the skin did, which might result in intestinal dilatation. He advises therefore that all patients with scleroderma submitted to KPAB therapy should have a preliminary complete roentgenization of the entire gastro-intestinal tract and the treatment should begin cautiously with 4 to 6 gm. per day.

In highly resistant cases of dermatitis herpetiformis PABA was of much value as long as its use was continued. The author indulges in no speculations as to the possible mechanism involved in the effects of PABA in lymphoblastoma cutis, scleroderma and certain cases of dermatomyositis. Among toxic reactions observed were drug fever and dermatitis medicamentosa, and there was one of toxic hepatitis. Nausea is the most frequent reaction, and a reducing substance, probably not glucose, occurs in the urine of all patients taking large doses of PABA.

D. E. H. CLEVELAND

## Surgery

**Rationale of Therapy in Acute Vascular Occlusions based upon Micrometric Observations.** Martin, W. B., Loufman, H. and Tuell, S. W.: *Ann. Surg.*, **129:** 476, 1949.

Using the vessels in the dog's mesentery, the changes in the size of small vessels were measured before and after mesenteric vein or artery occlusion. The effect of various drugs and sympathectomy were studied in a series of such experiments. Oxygen therapy had no effect on vessel calibre. Papaverine was of value in releasing some of the reflex arterial vasospasm after venous occlusion. It eradicated residual spasm after the release of arterial occlusion. Tetraethylammonium chloride counteracted the vasospasm following venous occlusion in only 50% of cases, and was without value in acute arterial occlusions. Sludge formation occurred quickly after venous or arterial occlusion and appeared to be a precursor to thrombosis. Heparin and dicoumerol prevented thrombosis formation but did not appreciably alter the character of sludge. Since vasodilators did not affect thrombosed small vessels, anticoagulants would seem to be a necessary part of therapy in acute occlusions.

Regional sympathetic denervation relieves small vessel spasm more efficiently than generalized vasodilators. Though after the removal of the occlusion such drugs counteract the residual vasospasm. The regulation of arterial calibre after occlusion depends primarily on sympathetic stimulation and secondarily on blood flow.

BURNS PLEWES

## Obstetrics and Gynæcology

**The Pathology and Repair of Genital Prolapse.** Pacey, K.: *J. Obst. & Gyn. Brit. Emp.*, **56:** 1, 1949.

For stress incontinence after total hysterectomy. In the absence of prolapse of the vaginal walls, the operation follows the same lines described elsewhere. With prolapsing vaginal walls, the front wall is opened from meatus to vault as in the prolapse operation. The same layers are found and the bladder is mobilized widely. This is surprisingly easy. With the bladder retracted upwards, it is possible, with tissue forceps inserted through the angles of the wound in the vault, to secure the remains of the cardinal ligaments. When these have been sutured the repair proceeds along routine lines.

Modification of the Mayo operation of vaginal hysterectomy. Mayo's operation is an admirable one when the uterus has to be removed in the presence of

prolapse. If stress incontinence complicates the picture further, the operation must be modified. It proceeds along routine lines until all the layers have been defined. The uterovesical peritoneal reflection is now opened and the uterus removed in the usual way. Following suture of the broad ligaments, cardinal ligaments and utero-sacral ligaments, the pubocervical ligaments are sutured to each other and the united cardinal ligaments are sewn to the back of them. It is now that the pubococcygeus muscles must be united. The operation finishes with the suture of the mucosal edges. P. J. KEARNS

**Some Observations on the Aftercoming Head.** Baxter, J.: *J. Obst. & Gyn. Brit. Emp.*, **56:** 95, 1949.

Experience suggests that malpositions seldom follow version, and even rarer must be the complication described by McCullagh (1933). Apparently in some cases with extended legs, the legs still retain their position relatively to the head and a foot may come down into the pelvis with the head. He believes that when x-ray examination after version shows the presentation to be a head and also extended legs, the breech should be returned to its original position. Version is not without danger to both mother and fetus. Its performance sometimes requires deep anæsthesia—a danger in itself. Rupture of the uterus is always possible, particularly when the patient is deeply anæsthetized, while separation of the placenta can be an alarming experience for both doctor and patient. Premature labour and stillbirth are occasional sequelæ.

External version has been strongly advocated in the past as the procedure most likely to reduce the figures for stillbirth and neonatal death resulting from breech labour. In those schools where the figures for breech delivery are comparable, or nearly so, with those resulting from normal labour, version may be regarded as carrying a greater risk than breech labour itself. For many of us, however, version when it can be performed is still the best solution of our problem. P. J. KEARNS

**The Significance of Clostridium Welchii in the Cervical Swab and Blood-Stream in Postpartum and Post-abortum Sepsis.** Ramsay, A. M.: *J. Obst. & Gyn. Brit. Emp.*, **56:** 247, 1949.

Although a considerable literature relating to the characteristics of severe *Cl. Welchii* infection of the uterus and bloodstream has accumulated, little has been said about the occurrence of the organism as a saprophyte or in connection with mild infective states. A survey of the work in the London County Council Puerperal Sepsis Unit over the decade 1937 to 1946 indicates that the large majority of *Cl. Welchii* infections are mild. Review of the literature shows that the greatest danger from introduction of *Cl. Welchii* into the vagina occurs in those cases in which the fetus dies *in utero* and is retained some hours: here is the perfect medium in which the organism may grow, and grow so profusely that the infection spreads. To a lesser extent the same conditions are provided by muscle devitalized as a result of gross maternal trauma. P. J. KEARNS

## OBITUARIES

**Dr. Stanley Arnold Banfill** died on August 23, at Austin, Que., in his 80th year. He was born at South Bolton on September 18, 1869. After attending the McGill Normal School, he taught school for a time at Farnham, Que., and later at Magog. He studied medicine at McGill University, obtaining his degree in 1898. After practising medicine for a time at Magog, he moved to East Angus in 1899 where he continued to practise until his retirement in 1943, brought about by ill health. Dr. Banfill maintained a life-long interest in education, serving for many years as chairman and as member of the East Angus Protestant School Board. He was a life member of the Montreal Medico-Chirurgical Society and a member of the East Angus and of the Canadian Medical Association.

He is survived by his widow, two sons, and five daughters.

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**Dr J. Honorius Bégin** est décédé à Sherbrooke, Que., le 14 septembre à l'âge de 57 ans. Né à Lévis, il fit ses études classiques au séminaire St. Charles-Borromée de Sherbrooke et son cours de médecine à l'université de Montréal. Il laisse son épouse et trois filles.

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**Dr. Miles G. Brown** died on September 5 in Hamilton General Hospital. Born at St. Stephens, N.B., he attended Queen's University, Kingston, Ont., and graduated in medicine in 1916. He joined the staff at the Hamilton hospital in 1919 and in 1939 was appointed medical superintendent. He was appointed a member of the American College of Hospital Administrators in 1944. He was a member of St. Andrew's Lodge, Ancient Landmarks Lodge and Scottish Rite; the Gyro Club and Burlington Golf Club, and was an elder in St. Paul's Presbyterian Church. Surviving are his widow, a son and a brother.

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**Dr. James Cochrane Carlyle**, of Toronto, died on July 27. He graduated in medicine from the University of Toronto in 1886.

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**Dr. James Lyall Cock, O.B.E.,** retired Chief Medical Officer for the port of Halifax died at his home on October 2, 1949, after nearly a year's illness. He retired in June, 1948, after completing 20 years with the Canadian Immigration Department at the port of Halifax. He served for a time as a member of the overseas immigration medical staff. Born in Truro, son of the late Mr. and Mrs. Herbert Cock, Dr. Cock served during World War I as a Lieut.-Col. in the First Medical Services Unit. He saw distinguished service with this unit overseas from 1914 to 1918. He was educated in Truro and was a graduate from Dalhousie Medical School in 1902.

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**Dr. Frank F. Chute,** aged 55, died in Ottawa on August 29, after a lengthy illness. A native of Berwick, N.S., he graduated from Acadia University and received his medical degree at Dalhousie University, Halifax, practising for 18 years at Canning, N.S. He was appointed to the Pension Commission in 1938. Survivors include his widow, one son, two daughters, two brothers and two sisters.

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**Dr. Joseph Murray Doyle** of Chicago died of a cerebral hæmorrhage and carcinoma on April 28. He graduated in medicine in 1893.

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**Dr. John McArthur Dunsmore** of St. Joseph, Missouri, died on May 16. He suffered a fracture of a lumbar vertebra. He graduated in medicine from Trinity in 1898.

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**Dr. R. L. Ellis** died in September at Jacquet River, N.B. Born in Youghall, Gloucester County, in 1875, he received his early education at the local school there and at the Grammar School in Bathurst. He received his degree in medicine at McGill University, Montreal, where he ranked high in all courses. He entered private practice at Jacquet River in 1902, where apart from his medical interests he operated an amateur radio station of his own construction. He is survived by his widow, three daughters and two sisters

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**Dr. John Howard Gillis** died in Montreal on September 17, in his 76th year after a long illness. Born in Tidehead, New Brunswick, he graduated from McGill in 1904. He had practised in Point St. Charles since 1913. In sport circles he was past president of the Quebec Rugby Football Union and the Canadian National Football Club. Soccermen knew him too as past president of Sons of Scotland and he was for many years on the executive of the Engineers Basketball Club.

A prominent Mason he was Past Master of University Lodge. Besides his wife, he leaves two sons, two daughters, two brothers and two sisters.

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**Dr. Hector A. Grant**, aged 70, of Big Bras d'Or died in North Sydney Hospital on September 28, 1949, after a lengthy illness. A native of Big Bank, Boularderie, he practised at Cape North, Neil's Harbour, Whycocomagh, Little Bras d'Or and North Sydney. He returned to Big Bras d'Or some years ago. He was a graduate of Dalhousie School of Medicine in 1909.

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**Dr. Charles K. P. Henry**, aged 71, died on September 14, at his home in Toronto after a seven-week illness. Born in Ottawa, Dr. Henry graduated at McGill University and practised in Montreal until 1947 when he retired because of a heart ailment. Dr. Henry established the first radium treatment clinic at the Montreal General Hospital and was director of the thyroid clinic. In 1916 he performed the first known blood transfusion in Montreal. He was past president of the Canadian Association of Clinical Surgeons, Fellow of the Royal College of Surgeons, Fellow of the American College of Surgeons, member of the Canadian Medical Association, and of the Medico-Chirurgical Society of Montreal. For the last 46 years Dr. Henry had been closely associated with McGill University. He started as assistant demonstrator in 1903, became assistant demonstrator in clinical surgery in 1906 and in 1907 was named demonstrator for the ensuing five years. In 1912 he was appointed demonstrator in clinical surgery and held that position for 11 years. In 1929 he was named assistant professor in surgery and became a full professor in 1941. Later he was appointed chairman of the department of surgery at McGill. He was chairman of the Medical Board of the General Hospital for two years before joining the consulting staff in 1943. He was chairman of the Montreal General Hospital Radium Therapy Committee from its inception. He held the position of president and vice-president in the Westmount Athletic Association between 1902 and 1907. He was a member of the University Club of Montreal and for many years was a director of the Royal Automobile Club of Canada.

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**Dr. William Darby Higgs** died suddenly at his home in Victoria on September 6. He was 47 years of age. He had practised in Victoria for the past eight years, coming here from Port Alberni. Dr. Higgs was born in Calgary, Alta. He is survived by his widow, his mother, four sisters, and one brother.

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**Dr. Andrew Murray Jeffrey**, aged 61, died in Ottawa on September 8. He specialized in tuberculosis cases. For the last 15 years he was on the staff of the Royal Ottawa Sanatorium and for several years was in charge of the Ottawa Tuberculosis Association's Mayfair Clinic. A native of Toronto and a graduate of the University of Toronto in 1916, he served with the Royal Army Medical Corps in the First World War as a battalion medical officer. A lover of sports in his younger days, Dr. Jeffrey went in for swimming and rowing at the Argonaut Rowing Club.

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**Dr. Secord Herbert Large** of Cleveland, Ohio, died in March. He graduated in medicine from Trinity in 1893.

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**Dr. Robert Archibald McArthur**, of Chicago, died on July 6. He graduated in medicine from Trinity in 1889.

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**Dr. Alexander Clarence MacPhee**, aged 37, a member of the Canadian Immigration Mission with headquarters in Karlesruhe, Germany, died in the American Hospital at Bremmerhaven, Germany, September 1, six days following an accidental fall. Born in Alexandria, Ont., in 1912, he was educated at Alexandria High School and the University of Toronto where he graduated in medicine in 1938. He interned at Toronto General Hospital and the Hospital for Sick Children. For a time he was on the staff of the Tubercular Sanatorium at St. Catharines, Ont., before, in December, 1939, going to El Dorado in the Northwest Territories. Dr. MacPhee joined the R.C.A.F. in July, 1940, serving as medical officer in Winnipeg, Fort William, Virden, Man., and Yorkton, Sask. He completed a course in aviation medicine at Toronto and as well became a qualified pilot before leaving for overseas in December, 1941. He was stationed in England and Scotland with the 410th Squadron before joining the famed 417th Desert Squadron for service in North Africa, Egypt, Sicily, Malta and Italy. Returning to Canada in November, 1944, with the rank of Squadron Leader, he retired to civilian life in 1945 and did postgraduate work in surgery and heart and lung work for two years at Toronto.

In January, 1947, he received an appointment with the Canadian Immigration Overseas Mission. Since that time he had served in London, England, and Karlsruhe, his work carrying him throughout Germany and Austria. He is survived by his mother, three brothers and three sisters.

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**Dr. Aaron Magid** of Niagara Falls, Ont., died on August 4. He graduated in medicine from the University of Manitoba in 1928.

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**Dr. G. Spencer Melvin**, former dean of medicine at Queen's University, died on September 12, in Kingston, after a long illness. He had been a member of the faculty staff since 1919 and also served as professor of physiology. He retired last July. A graduate of the University of Aberdeen, Dr. Melvin came to Canada in 1919, after serving in the First World War with the Royal Army Medical Corps. Surviving are his widow, one son, and a daughter.

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**Dr. A. R. Myers** died unexpectedly in Hotel Dieu, Moncton, N.B., on August 26. He came to Moncton shortly after graduating from Queen's University, Kingston, Ont. He was a past president of the New Brunswick Medical Association, a past vice-president of the Canadian Medical Association and a Fellow of the Royal College of Surgeons. He served as coroner for many years. In 1905 he did postgraduate work in Berlin, Paris and London. After 55 years of active practice he retired several years ago. Surviving are his widow, two sons and one daughter.

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**Dr. E. Victoria Reid** of Toronto, died on June 17. She graduated in medicine from Queen's University in 1904.

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**Le Dr N. Arthur Sabourin** est décédé subitement, le 24 septembre à sa demeure à St. Jean, Que.

Né à S.-Urbain de Châteauguay, le 26 octobre 1870, il avait fait ses études à l'Académie commerciale de S.-Jean et aux universités d'Ottawa et Laval, de Montréal. Le Dr Sabourin s'était distingué dans l'arène politique et avait été candidat à trois reprises dans le domaine provincial pour le comté de S.-Jean. Il avait été conseiller municipal pour la ville de S.-Jean de 1908 à 1912, lieutenant-colonel et commandant du régiment de Châteauguay en 1909, gouverneur du Collège des médecins, membre et président de la commission scolaire de S.-Jean pendant plusieurs années. Il était coroner pour le district de S.-Jean et Iberville depuis 15 ans de même que membre actif du conseil 1145 des chevaliers de Colomb.

Il laisse trois fils, trois filles, deux frères et une sœur.

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**Dr. Frederick Smith**, dean of the faculty of medicine of McGill University, died while delivering a welcome address to first year students on September 7. Born in Bradford, England, in 1903, he received his university training at Cambridge University, where he was for a time a student under Professor E. G. D. Murray, who subsequently was instrumental in bringing him to McGill. Dr. Smith held B.A., M.A., M.B.,

and B.Ch. degrees from Cambridge. He was also an M.R.C.S., England, L.R.C.P., London, and a Fellow of the Royal Society of Canada. First a lecturer in bacteriology at McGill in 1931, he was promoted to the rank of assistant professor in 1936, associate professor in 1938, professor in 1946, associate dean of the faculty of medicine on March 12, 1947, and dean on July 1, the same year.

He is survived by his widow, three young children and a sister.

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**Dr. James Sutherland** of Spokane, Wash., died of a coronary occlusion on March 31. He graduated in medicine from Trinity in 1891.

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**Dr. John L. Todd** was killed in an automobile accident at St. Anne de Bellevue, Quebec, August 27. Born in Victoria in 1876, he was educated at Upper Canada College, Toronto, and McGill University, Montreal. He graduated from McGill in 1900. In 1902-05 and 1911 he conducted expeditions for the Liverpool School of Tropical Medicine to Senegambia and the Congo Free State in West Africa, where he carried out research on tropical diseases. He subsequently became director of the Runcorn Research Laboratories at Liverpool School of Tropical Medicine. From 1907 to 1926 he was associate professor of parasitology at McGill. He served in the Canadian Army Medical Corps during the Great War, reaching the rank of major. He was Canadian pension commissioner from 1916 to 1919, and a member of the Typhus Research Commission, League of Red Cross Societies, in Poland in 1919.

Dr. Todd, a member of the Royal College of Surgeons in England, held an honorary doctor of science degree from Liverpool University; Commander of the Order of Leopold II, a Belgian decoration; Mary Kingsley Medal from Liverpool School, and Chevalier of the Order of Polonia Restituta. At the time of his death Dr. Todd had been living in retirement for many years. He is survived by three daughters and two sisters.

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**Dr. Claude Samuel Wainwright** of Orillia, Ont., died on May 27. He graduated in medicine from the University of Toronto in 1901.

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**Dr. Jean M. Willson**, aged 81, one of Toronto's first women physicians, died on September 26 at her home in Toronto. Born at Lyn, Ont., she graduated in medicine from the University of Toronto in 1896 and spent some years as a pathologist at the Delaware State Hospital, before establishing a practice in Toronto. In her younger years, she was an active member of the former James Square Presbyterian Church. She was a member of the Ontario Medical Association. She leaves a sister-in-law, Mrs. C. H. Willson, with whom she made her home.

# NEWS ITEMS

## Alberta

The annual convention of the Alberta Medical Association was held in the Medical Building of the University of Alberta on September 21 to 23. The visiting guest speakers were: Dr. J. F. C. Anderson, President of the Canadian Medical Association; Dr. J. Wallace Graham of Toronto; Dr. N. W. Philpott of Montreal; Dr. T. A. Watson of Saskatoon and Dr. T. C. Routley the General Secretary of the Canadian Medical Association. Dr. G. Ellis the President of the Alberta Division of the C.M.A. held a reception for the members of the profession at the MacDonald Hotel on September 21.

The ladies' program was one of the most active and successfully carried out affairs held in this Province. The program consisted of a "coffee" gathering at which were one hundred wives of the medical men; a golf tournament at Mayfair, the high scorers being Mrs. Frank Law and Mrs. E. H. Watts; the Edmonton Academy afternoon reception; and the banquet and dance on September 22. At the annual dinner Dr. G. Ellis presented Dr. R. M. Parsons of Red Deer with the badge of office as the incoming President. This lovely badge and chain was a gift of Dr. A. E. Wilson of Calgary when he retired from this office last year and the presentation will be an annual event through the years. Dr. P. H. Sprague of Edmonton is President-elect.

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Dr. Herbert Claxton of Brooks was an attendant at the Alberta medical convention.

W. CARLETON WHITESIDE

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## British Columbia

At the Annual Meeting of the British Columbia Medical Association, held in Victoria September 28, 29 and 30, the following were elected to office for 1950: President—Dr. J. C. Thomas, Vancouver; President-Elect—Dr. S. A. Wallace, Kamloops; Vice-president—Dr. H. A. L. Mooney, Courtenay; Hon. Sec.-Treas.—Dr. John Ganshorn, Vancouver.

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The new Crease Clinic of Psychological Medicine at Essondale, is now nearly complete, and should be ready for operation at a very early date. The object of this Clinic is to bring the treatment of mental illness into the field of general medicine, and its emphasis will be on preventive work, and on early treatment and cure. A great deal of the legal formality of admission to a mental hospital will be removed, and admission will be greatly simplified. It will accommodate 325 patients.

The building, 622 feet in length, and four stories in height, is completely modern, and is a model of its kind. Special provision is made for surgery, and all modern therapeutic methods. It will be an active teaching and training centre, in close connection with the Medical Faculty of the University of British Columbia, will have a library, pathological museum, lecture hall and all teaching facilities.

To the Hon. George S. Pearson, B.C. Minister of Health, goes a great deal of the credit for the completion of this Clinic, which, as the name implies, is a monument to the work of Dr. A. L. Crease, who has been associated with the Essondale Mental Hospital for 34 years, and its director for 24 years. His work here, as everyone in his field admits, has been outstanding, and he has always laid special emphasis on early recognition and treatment of mental illness.

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The death of Dr. Glen A. Campbell, of Vancouver, at the age of 81, marks the passing of a pioneer in the field of ophthalmology in B.C., where he had been in practice for nearly 50 years. He was a graduate of Bishop's College and McGill, and his name has been a household word in Vancouver for nearly half a century.

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The latest reports on the working of the B.C. Hospital Insurance plan bring out several reasons for the reported deficit that 1949 will show, of some three and a half million dollars. It was inevitable, perhaps, that all the factors in the case, affecting any estimate of cost, could not at first be recognized. Thus there has been an enormous rise in wage and salary costs, which constitute 65% of hospital costs. The deficit referred to almost exactly matches this rise. There are 76 hospitals taking part, and some 6,500 employees. Practically in every case, and in every branch of work, wage and salary increases have been considerable. Food costs, too, have risen steadily. There is no doubt, too, that the amount of service given per patient, in the form of x-ray service, laboratory work, special treatments, has increased greatly. In view of all this, the deficit is not so surprising, perhaps. It will be met by an increase

in premiums, that for single individuals rising from $15.00 to $21.00 annually, while that for married people is increased from $30.00 to $33.00.

Sir John Parkinson, of London, England, has arrived in Vancouver, and will be Chief in Medicine at the Vancouver General Hospital from October 3 to 7 inclusive. In addition to clinics, etc., given at the Hospital, Sir John will address the Vancouver Medical Association on October 4, on "Cardiac Radiology".

## Manitoba

It is understood that the Province of Manitoba and the Dominion Department of National Health and Welfare will make a total donation of $416,000 to the City of Winnipeg for the new Princess Elizabeth Hospital for chronic invalids. The hospital is almost ready for opening.

A Winnipeg radiologist, Dr. E. T. Felsted, who has specialized in research on radioactive isotopes for medical treatment, will do further research at the Royal Cancer Hospital of London. Holder of the Scientific Club's prize and the University medal for physiologic research, Dr. Felsted has studied at Chalk River, Vancouver General Hospital and the University of California Hospital.

Hon. Paul Martin, Federal Minister of National health and welfare, has approved a $5,000 for staff additions and health education services in the St. Boniface health unit.

After a lapse of eight years due to the war, the Gordon Bell Memorial Lecture was renewed under the auspices of the Winnipeg Medical Society. The thirteenth lecture was given in Grace Church, Winnipeg, on September 14, by Sir Lionel Whitby, M.C., M.D., C.V.O., F.R.C.P., Regius Professor of Physic at Cambridge and immediate Past-president of the British Medical Association, before a closely attentive audience. His theme was the rise of preventive medicine, a theme suggested by the bicentenary of Edward Jenner. He noted that the most effective medical advances in the past had been against ailments with external causes. He predicted that the most intensive research and the most spectacular discoveries of the future would be in internal diseases, particularly those affecting people beyond midde age on which "very little progress" had hitherto been made.

Dr. T. E. Holland, President of the Winnipeg Medical Society, occupied the chair, Dr. Ross Mitchell introduced the speaker, and Dr. Lennox Gordon Bell, newly appointed Dean of the Faculty of Medicine, and only son of the late Dr. Gordon Bell, moved the vote of thanks.

Sir Heneage Ogilvy of London, Eng., will address the Winnipeg Medical Society in December.

Dr. L. P. Lansdown has been appointed pathologist at the Provincial Laboratory in the Medical College, Winnipeg. A graduate of the Faculty of Medicine, University of Manitoba, he has been medical director of the Swan Valley Health unit since April, 1947.

Donald W. Richmond, assistant secretary of Manitoba Pool Elevators presented on September 9 a $3,000 cheque to the Whitemouth District Hospital Board for its 10-bed hospital. First sod for the hospital was turned on July 30. It will be completed in March, 1950. The cheque was the twenty-first donation of similar amount from the Manitoba Pool Elevators Hospital Memorial Fund.

Dr. Donalda Huggins, of the Department of Anæsthesiology, Winnipeg General Hospital, has left Winnipeg for an extended tour of Sweden and England in company with Dr. Virginia Apgar, head of the Department of Anæsthesiology, Presbyterian Hospital, New York City.

Voting will take place on October 21 in the Neepawa and Gladstone area on the formation of two new hospital districts and the construction of five hospital units. If the vote passes by the necessary three-fifths majority it will automatically authorize construction of a new $200,000 thirty-bed hospital in Neepawa and a six-bed nursing unit in the village of Glenella, a $150,000 sixteen-bed hospital in Gladstone and two four-bed nursing units in Plumas and Langruth.

Victoria Hospital in Winnipeg is building an addition which will almost double the size of the hospital.

Dr. A. A. Earn has been given the Neil John Maclean memorial award in clinical research. Dr. Earn's research has particular reference to the early diagnosis of cancer. The award of $100, given annually for the best paper submitted by younger men working at the Winnipeg General Hospital, was awarded at a hospital staff meeting on October 6. Dr. Earn is now on the university staff.

Sir John Parkinson, London, Eng., addressed the Winnipeg Medical Society on October 12 on the subject "Difficulties in Cardiac Diagnosis".

ROSS MITCHELL

## New Brunswick

The commissioners of the Saint John General Hospital have established a separate department of Gynæcology. The staff will be Dr. Geo. White, Chief of Department with Dr. Jos. Tanzman and Dr. F. D. Wanamaker as seniors.

Hon. Dr. F. A. McGrand announces the opening of a new Cancer diagnostic clinic at St. Stephen. Dr. H. S. Everett is the chairman in charge and Dr. E. Stiles will act as alternate chairman.

A. S. KIRKLAND

## Nova Scotia

Dalhousie University Medical School will hold its twentieth refresher course October 24 to 28 inclusive, 1949. As guest teachers will be Sir James R. Learmonth, Professor of Surgery, Edinburgh University, who will give the first John Stewart Memorial lecture in surgery; Dr. Willard Owen Thompson, Professor of medicine at the University of Illinois, speaking on endocrine problems; Dr. Gordon Murray, University of Toronto, speaking on the surgery of the heart and on the artificial kidney; Dr. William Reggio, Medical Director, Public Health Service, Washington, D.C., speaking on the problems of rehabilitation; Dr. John L. Fromer, head of the Department of Dermatology, Lahey Clinic. The Faculty of the Medical School will participate as usual.

Running concurrently with the refresher course will be a clinical meeting of the Canadian Anæsthetic Society, and the regional fracture committee of the American College of Surgeons will hold its meeting. All sessions will be held at the Victoria General Hospital and the Lord Nelson Hotel.

H. L. SCAMMELL

## Ontario

Dr. Norman Shenstone, Toronto, delivered the Tudor Edwards Memorial Lecture before the Royal College of Surgeons in London. His subject was The Treatment of Bronchiectasis.

Dr. Alexander F. McKenzie, of Monkton, at 85 is Canada's senior medical doctor in active practice. For a time, during the first war he was assistant superin-

tendent of the Toronto General Hospital. In addition to his medical contributions to Monkton he assisted in the establishment of a public library in the village; helped to plan and lay out a park, organized the Perth Medical Society in 1913, was chairman of a committee on education for the Ontario Medical Association. Under his leadership the first schedule of papers, demonstrations and material for postgraduate study was issued. Dr. Kenneth G. McKenzie of Toronto is his son.

Judge Eric Cross of Woodstock, one-man Ontario Royal Commission of inquiry into affairs of city-owned Metropolitan General Hospital, Windsor, has issued a 12,000 word report recommending an improved system of budgeting and financing, clearer definition of medical staff duties; more efficient recording of clinical histories; revision of hospital by-laws and an eleven-man hospital board. Three members would be appointed by city council; one by the Windsor Chamber of Commerce; one by the Metropolitan Aid Society; four by the Hospital Trust Association; one by the medical staff and one by the county council, the terms to range from one to two years.

The vital statistics for Ontario for August are 9,160 births, 4,898 marriages and 3,268 deaths.

Dr. Martin A. Fischer has opened an office for the practice of Psychiatry at 167 College St., Toronto.

Dr. Thomas Russell F.R.C.S.[C.], has opened an office for the practice of Urology in the Medical Arts Building, Toronto.

Dr. Benjamin Winter, F.R.C.S.(Edin.), has opened an office for the practice of general surgery and surgery of the chest including bronchoscopy and œsophagoscopy at 206 Bloor West, Toronto.

Dr. Patricia Wilford has opened an office for the practice of general medicine at 310 Bloor West, Toronto.

A memorial service honouring the centennial of Sir William Osler's birth was held at Trinity College School, Port Hope on Sunday October 2. Dr. L. W. Brockington, rector of Queen's University, gave the address. Sir William was first head prefect of the school when, in 1866, it was the private home of Rev. W. A. Johnson at Weston. The school moved to Port Hope in 1868. After the ceremonies a reception was held for members of the Osler family. Mrs. Douglas Fisken, a grand-niece, who had been his secretary when he was Regius Professor at Oxford, presented the school with a reproduction of Sir William's picture by Sargent. LILLIAN A. CHASE

Dr. Philip A. Ryan, M.D., F.R.C.P.[C.] is opening an office at 630 St. Clair Avenue West, Toronto.

Dr. J. S. Cull has been appointed Assistant National Director (Administration) of the Red Cross Blood Transfusion Service. He will move from Vancouver to Headquarters in Toronto. Dr. Cull served his internship in old Grace Hospital, Toronto.

Sir Lionel Whitby, C.V.O., M.C., Regius Professor of Physic, Cambridge University, lectured at the Banting Institute on September 12 on "The Present Position regarding Leukæmia".

Toronto's Mount Sinai Hospital will receive a grant of $379,666 from the Province toward construction of the new hospital on University Avenue. This will add 351 beds and 86 bassinettes to existing accommodation in the city.

The Province of Ontario has granted $72,845 for the construction of a new Red Cross Hospital at Nipigon.

Under the Federal Health plan Ontario received more than $743,000 a year for the extension of tuberculosis control measures. The Ontario Government has been meeting the costs not paid by patients for periodic pneumothorax refills for ex-sanatorium patients. With the aid of a National Health grant the service now becomes free to all who need it. The sum of $10,000 has been allotted for the current fiscal year to help meet the costs of maintaining tuberculosis patients at the Ongwanada Sanatorium, Kingston. This D.V.A. hospital was taken over by the East Counties Tuberculosis Association for civilian patients as well as war veterans.

The Federal Government has agreed to meet the costs of increasing the staff and equipment of the Nursing School of McMaster University, Hamilton, Ont., and to assist in the establishment of a laboratory in Hamilton for the study of the value of radioactive isotopes in medical diagnosis. The latter will be operated by the Hamilton Medical Research Institute.

A Section of General Surgery was approved by the Council of the O.M.A. at the annual meeting in London. Dr. Neil MacDonald is chairman and Dr. R. K. Magee is secretary.

Autumn Postgraduate Courses in Surgery, Medicine, Obstetrics and Gynæcology were held at Queen's University from September 12 to 17.

During 1948 the Province of Ontario spent nearly $150,000 for biological products used in immunization against preventable diseases. NOBLE SHARPE

## Quebec

The 17th annual fall clinical convention of the Montreal Medico-Chirurgical Society was held in the first week of October. Nine hospitals took part, and six full days of demonstrations, ward rounds, and round table conferences were held. The attendance was in the neighbourhood of 300, including as usual many men from other provinces and from across the border. Each hospital was host in turn at luncheon to the visitors, and on Thursday, October 6, a combined banquet with the Graduates Society of McGill was held at which the centenary of Osler's birth was celebrated, the guest speaker being Dr. Wilburt C. Davison, Dean of Duke University School of Medicine. The organization and conduct of this clinical week has long since become an important event in the medical calendar of the Province.

## Saskatchewan

One hundred and seventy-nine doctors registered for the forty-second annual meeting of the College of Physicians and Surgeons of Saskatchewan which was held in Regina, September 15, 16 and 17, 1949. The two guest speakers were Dr. L. B. Pett, Ottawa, Department of National Health and Welfare who gave a paper entitled "Clinical Signs of Nutritional Deficiencies in Canada", and Lieut.-Col. Morgan-Smith who presented a paper "Atomic Bomb Casualties". Other papers presented by Saskatchewan men included a report on general practice in health region No. 1 and orthopædic, obstetrical and surgical problems in general practice.

A new wing to the Regina General Hospital was officially opened on Wednesday, September 14 at a public ceremony. The wing will include the entire departments of pædiatrics, maternity facilities and radiology, including diagnostic and therapeutic x-ray services. Some 354 beds will be in the new wing, bringing the hospital's bed capacity to 855. Adequate office space, working facilities and waiting room will be made available by the opening of the new wing. The opening of this new wing, which will be in full

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operation in a few months, will permit the presently heavily-taxed facilities in other section of the hospital to be expanded.

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Having observed the operation of Swift Current Health Region carefully and noting its administrative difficulties, the following opinion was expressed at the Annual General Meeting held in Regina:

"WHEREAS, indications point to proposed expansion of medical services in Saskatchewan on the basis of pre-determined small health regions,

"WHEREAS, the geographical boundaries established to define these regions create barriers to the availability of complete medical and specialist services,

"AND WHEREAS, small regions are completely dependent upon local economic conditions,

"AND WHEREAS, this may result in a demand for unlimited medical services for limited funds,

"THEREFORE BE IT RESOLVED, that the College of Physicians and Surgeons of Saskatchewan is opposed to the expansion of health insurance or prepaid medical services on the basis of local health regions as defined in the Health Services Act, 1946."

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Dr. Maurice Hubar, formerly of Lumsden is now practicing at Mankota; Dr. C. H. McCreary who practiced at Rockglen has moved to Waldheim; and Dr. M. R. Kliman, has moved to Saskatoon from Mankota and will be instructing at the University of Saskatchewan.

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Dr. H. C. Burroughs who practised for a number of years at Swift Current, Saskatchewan, is now located at Lumsden, Sask.

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Dr. and Mrs. William Oliver left recently to reside in Montreal. Dr. Oliver retired from thirty-seven years of active practice and for the past fifteen years has been Saskatoon's coroner. G. G. FERGUSON

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## General

**Laboratory Technologists.** During the month of November, Miss Ileen Kemp, President of the Canadian Society of Laboratory Technologists, will visit the cities of Western Canada in the interest of the Society and of the individual technicians. The Canadian Society of Laboratory Technologists has done much to raise the standards of laboratory workers, and it should be the desire and ambition of all qualified technologists to be admitted to the official registry which it maintains.

While no change in the qualifications required for registration with the C.S.L.T. is planned, it is the intention of the Society and its examining board to give careful attention to the application of each candidate for registration. Those technicians whose academic and technical training meets the requirements will be encouraged to qualify themselves by examination.

Miss Kemp plans to call on the directors of laboratories and to arrange meetings of technologists at the following points: Victoria, Vancouver, Lethbridge, Medicine Hat, Calgary, Edmonton, North Battleford, Prince Albert, Saskatoon, Regina, Yorkton, Brandon, Winnipeg, Fort William and Port Arthur.

It is requested that doctors interested in the maintenance of a high standard of clinical laboratory services encourage the attendance of technologists at the meetings which will be announced in the local papers in advance of Miss Kemp's visit.

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**Refresher Course in Ophthalmology and Otolaryngology.** The Faculty of Medicine of the University of Toronto offers a combined refresher course in Ophthalmology and Otolaryngology from January 9 to 14, 1950. The Otolaryngological subjects will be presented during the first three days of the course and the Ophthalmological subjects during the last three days. Lectures and surgical clinics in both subjects will be given by outstanding guest speakers as well as by members of the Faculty. Guest speakers: Otolaryngology, Dr. W. J. McNally, Montreal and Dr. Henry Orton, Newark, N.J.; Ophthalmology, Dr. P. C. Kronfeld, Chicago and Dr. J. A. MacMillan, Montreal.

The Course will be given for a minimum of 10 and a maximum of 20 students. The fee for all or any part of the course will be $100 payable to the Chief Accountant, Simcoe Hall, University of Toronto. Application should be made to the Dean of the Faculty of Medicine, not later than November 30, 1949.

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The Council of the British Medical Association is prepared to consider an award of the Sir Charles Hastings Clinical Prize in the year 1950. The prize consists of a certificate and a money award of fifty guineas. The purpose of the prize is the promotion of systematic observation, research, and record in general practice. It will be awarded for the best essay submitted in open competition. The work submitted must include personal observations and experiences collected by the candidate in general practice. Candidates in their entries should confine their attention to their own observations in practice rather than to comments on previously published works on the subject, though reference to current literature should not be omitted when it bears directly on their results, their interpretations, and their conclusions. A high order of excellence will be required. No study or essay that has previously been published in the medical press or elsewhere will be considered eligible for the prize, and a contribution offered in one year cannot be accepted in any subsequent year unless it includes evidence of further work. The prizewinner in any year is not eligible for a second award of the prize.

Any member of the Association who is engaged in general practice is eligible to compete for the prize.

Essays must be forwarded so as to reach the Secretary, British Medical Association House, Tavistock Square, London, W.C.1, not later than December 31, 1949. The prize will be awarded at the Annual Meeting of the Association to be held in 1950. Enquiries relative to the prize should be addressed to the Secretary, Charles Hill.

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**Research Grants.** Applications for 1950 grants in aid of research on cardiovascular problems will be received by the Life Insurance Medical Research Fund up to January 1, 1950. Support is available for physiological, biochemical, and pathological research which bears on cardiovascular problems, as well as for clinical investigation in this field. Preference is given to fundamental research. It is expected that about $550,000 will be awarded for these grants.

Applications for postgraduate fellowships for training in research in 1950-51 will also be received by this Fund up to January 1, 1950. Preference is given to candidates who wish to work in the broad field of cardiovascular function or disease and to candidates who wish to work in institutions other than those in which they have obtained most of their experience. A doctor's degree (M.D. or Ph.D.), or the equivalent is required. The annual stipend varies, as a rule being between $3,000 and $4,000, with larger amounts in special cases. At least 12 postgraduate fellowships will be available. Further information and application blanks may be secured from the Scientific Director, Life Insurance Medical Research Fund, 2 East 103rd Street, New York 29, New York.

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**Postgraduate scholarship** of $1,500 is offered to a Canadian medical woman for 1950-1951. The grant will be made in April, 1950. This grant is being made by the Western Canada Region of Soroptimist Clubs, which is interested in fostering improved medical care in general in Canada, and particularly in supporting the work of Canadian medical women. The object of this grant is to promote special training in any field of medicine for a Canadian medical woman. The applicant is to be a woman whose graduation from a Canadian medical college has been within five years of application. Further information is available

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by writing Greta K. Currie, Director, Western Canada Region, Soroptimist Club.

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**The American Goitre Association** again offers the Van Meter Prize Award of three hundred dollars and two honourable mentions for the best essays submitted concerning original work on problems related to the thyroid gland. The award will be made at the annual meeting of the Association which will be held in Houston, Texas, March 9, 10 and 11, 1950. The competing essays may cover either clinical or research investigations; should not exceed three thousand words in length; must be presented in English; and a typewritten double spaced copy in duplicate sent to the Corresponding Secretary, Dr. George C. Shivers, 100 East St. Vrain Street, Colorado Springs, Colorado, not later than January 15, 1950.

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Arrangements have been completed between the National Safety Council and the National Film Society of Canada to release all Council films in Canada through the Society. Custom delays and other restrictions in the past have made distribution of Council films difficult, and the new plan is expected to be of great benefit to safety education programs in Canada.

The entire film library of the Council, consisting of sound slidefilms, motion pictures and film strips on industrial safety, foreman training, motor transportation, farm, school, home and public safety, will be available for rental, preview or loan. A free film catalogue and other information concerning the films can be obtained by writing Council headquaurters, 20 N. Wacker Drive, Chicago, Ill.

Rental charges in Canada will be $3 for the first day, $5 for the first week and $3 for each week thereafter. Preview charges for most films will be $3. Certain public service films will be available at no rental cost, other than transportation fees. Films should be booked directly from the National Film Society of Canada, 172 Wellington St., Ottawa, Ont.

## *Book Reviews*

**British Surgical Practice.** Sir E. R. Carling, Consulting Surgeon, Westminster Hospital and J. P. Ross, Surgeon and Director of Surgical Clinical Unit, St. Bartholomew's Hospital. 486 pp., illust., vol. 4. $15.00. Butterworth & Co. (Publishers), Ltd., London, 1948.

The subjects taken up in this volume range from Facial Palsy to Hiccup. The Canadian authors are extremely well represented with Fascial Grafts, by Dr. W. E. Gallie, who summarizes the use of Fascial Grafts, as only the originator and master can do, and Focal Epilepsy by Dr. Wilder Penfield, who has conveniently condensed his outstanding work on cerebral localization, with special reference to Focal Epilepsy. The Fallopian Tubes are well classified, and the table of tubal pregnancy is very helpful. Fistula in Ano, by the Staff of St. Mark's Hospital, London, is well illustrated, and the anatomy is described in detail in this article.

The Surgery of the Foot is dealt with; this includes strain, congenital and acquired deformities, as well as the minor surgery of the foot. There are clear illustrations; but a complete absence of radiographic reproduction. Mr. Holdsworth reviews Fractures and Dislocations. In seventy pages, remarkably few of the useful methods of treating fractures and dislocations are excluded. The only omission noted is damage to the rotator cuff of the shoulder joint; otherwise fractures of the upper limb is complete, practical and very helpful. Fractures of the lower limb are in line with American teaching, and greater emphasis is placed on open reduction in both the Femur and the Tibia, especially near the joints. The article on the Gall Bladder and Bile Passages is clear, with the "Moynihan", touch. The only criticism is in Cholecystenterostomy. The author recommends an anastomosis, 4 to 6 inches below the gall bladder. If this could be increased to not less than 20 inches, danger of infection from the bowel to the bile passages, would be lessened. The treatment of Gonorrhœa by penicillin has dramatically changed the outlook of this disease, in both men and women, but the same cannot be said for Gout, which still remains a problem disease. Hæmophilia and allied diseases are conveniently differentiated in tables and text. In contrast, the treatment of hæmorrhage omits mention of the recent Hæmostatics, such as, gelfoam, oxidized cellulose and alginates. This particular article is about 10 years old on any standard. Intra-arterial transfusion, under pressure, should also have been mentioned in this article. Articles on the Hand, Heart, Hernia and Heterotopia are clear, concise and complete, containing that delicate balance of theory and recent advances, with practical application, that is so valuable in an encyclopædia.

Having reached the half-way mark, it is possible to gain a clear picture of the whole work. The idea is excellent, the indexing, illustrations and the typographical arrangements are outstandingly clear, and easy to use. These volumes should be in all surgical libraries, and will set a standard of work that will be difficult to duplicate. Although a few weak articles have been cited, and their presence is probably inevitable in work of this magnitude with so many authors, this defect is negligible in the whole scheme. For examination purposes these volumes are obligatory, and for the surgeon in small communities they make an almost complete surgical reference library of great practical use.

**British Surgical Practice.** Edited by Sir E. R. Carling, Consulting Surgeon, Westminster Hospital; and J. P. Ross, Surgeon and Director of Surgical Clinical Unit, St. Bartholomew's Hospital. 559 pp., illust., vol. 5. Butterworth & Co. (Publishers), Ltd., London, 1948.

This volume of British Surgical Practice continues the wide plan of the previous ones and is truly representative of the practice of Surgery in the British Commonwealth. The authors outside the British Isles are drawn this time from South Africa and Australia. Professor H. R. Dew of Sydney has done a clear, concise and authorative review of Hydatid Disease. Of the six sections on the Kidney and Ureter, Professor Underwood of Witwatersrand has written the section on Hydronephrosis and pyonephrosis.

There are several sections of a general nature in this volume which begins with Hodgkin's disease and ends with lymphogranuloma inguinale. Dr. Bishop's article on Hormones is extremely helpful for the surgeon. He summarizes the principles of action and integration of the various hormones and tabulates their chemical nature so that the clinician is able to find his way through the dozen or more proprietary names for the same chemical substance. Hyperpiesia is appropriately written by Sir James Learmonth and there is a delightful chapter on Infection. Infections and Inflammation by Professor Cameron who writes with the sure touch of the master. The depth and breadth of his word picture of the process of inflammation is fascinating, with the pertinent facts of its history being brought into focus. One of the outstanding articles in the book is "Law in Relation to Surgery", which should be read by every surgeon. Mr. Stamm has reviewed Ligatures and Sutures in an able article. The table of Tensile Strengths is of little use, however, as both Catgut and Steel Wire are omitted and the gauges do not conform to the recently adopted American uniform standards. Lipoid Metabolism and Lipoid Granuloma is another of the medical topics which have been described for surgeons. In fact, this volume may be described as a general rather than a specialists' volume. There are excellent photographs throughout the volume and colour has been introduced to illustrate the article on the Surgical Diseases of the Larynx, Lupus Vulgaris and one on the Kidney. The general excellence of the presentation as regards indexing and marginal notes has of course remained the same, which makes this volume of great use to both the student, teacher and practitioner.

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**Modern Practice in Psychological Medicine 1949.** Edited by J. R. Rees. 488 pp. Butterworth & Co. (Publishers) Ltd., London, 1949.

Written for medical students and the general practitioner, this comprehensive book covers the subject of psychological medicine in a thorough, instructive manner and is definitely recommended. There is some overlapping of material. Many well-known British psychiatrists have contributed to the book. Russell Brain has written a chapter on the Neurological aspects. D. Ewen Cameron, Brock Chisholm and William Line are Canadian contributors to the volume.

**Operative Technique—General Surgery.** Edited by W. H. Cole, Professor and Head of the Department of Surgery, University of Illinois College of Medicine. 951 pp., illust. $16.00. Appleton-Century-Crofts, Inc., New York, 1949.

Thirty-four distinguished surgeons have contributed to the making of this excellent book. A companion volume on special surgery will be reviewed at another time. The work is a well worth-while summary of modern practice in surgery. It concerns itself primarily with principles. The only people it will disappoint will be those who are looking for a manual of operations with step-by-step details. The people who will read it with most profit will be young surgeons already trained in techniques and candidates for the higher qualifications such as Fellowship in the Royal College of Surgeons. Senior surgeons will enjoy reading a well done review of operative procedures as practised by acknowledged leaders in the profession. Approving comment might be made on every one of the 23 chapters did space permit. Canadian readers will be especially rewarded by the chapter on colon and appendix which was written by the late Roscoe R. Graham and his collaborator Jessie Gray of Toronto. The illustrations are well chosen. The legend under Figure 55 has confused the right and left leg but that was the only error detected in reading the book. Lists of references follow each chapter and the index is complete. Rare conditions, not discussed in the text, are indicated and the reader directed to a source of information.

**Mycoses and Practical Mycology.** N. Gohar, Assistant Professor, Parasitology and Mycology, Department of Clinical Pathology, Fouad I University, Cairo, Egypt. 234 pp., illust. $6.25. Baillière, Tindall & Cox, London; Macmillan Co. of Canada Ltd., Toronto, 1948.

This may be found to be a useful reference book, as most of the diseases described are accompanied by a lengthy list of the mycotic organisms which have been isolated from the lesions, including the name of the discoverer and date. There is also a good concise introductory chapter on fungi and their classification. The illustrations, photomicrographs, photographs and line drawings, are for the most part good and well produced. An attempt is made to cover the entire field of clinical mycology, including superficial and deep infections. The orientation is distinctly tropical, as might be expected. The subject matter is not well arranged and the result is confusing to general practitioner and specialist alike. Views are presented which are outmoded or which have never met with general acceptance. For instance it is surprising to find erysipeloid of Rosenbach presented as "a contagious form of actinomycotic dermatitis", and in discussion of treatment of scalp ringworm the use of thallium acetate is given pride of place and space over roentgen therapy, while in discussing the latter the x-ray dosage is measured by the Sabouraud-Noiré pastille, and there is no mention of measurement of roentgen output by modern methods with calibrated apparatus. The author's statement that "the present consensus is in favour of *Malassezia ovalis* as the causative agent" of pityriasis capitis (dandruff) cannot be accepted seriously. There is no general agreement on the specificity of any organism in this disease. The inclusion of such substances as ichthyol, "sulfa preparations" and penicillin among fungicides is astonishing to say the least. Other members of a list of "recently recommended fungicides" are mostly proprietary mercurial and other compounds which have been found generally of little use.

This book cannot be recommended as a practical or dependable one for the student or general practitioner.

**Surgical Technique and Principles of Operative Surgery.** A. V. Partipilo, Associate Clinical Professor of Surgery, The Stritch School of Medicine of Loyola University, Senior Attending Surgeon, Columbus Hospital. 676 pp., illust. $16.25. Lea & Febiger, Philadelphia; Macmillan Co. of Canada Ltd., Toronto, 1949.

The fourth edition of this useful book has much to recommend it. The section on surgery of the biliary tract has been rewritten and several new chapters added. Throughout the book physiological principles are stressed. The techniques described are those chosen by the individual contributors. The impossible task of describing all the modifications advocated in the literature has not been attempted, although suggestions of such modifications are freely made and credit given to their originators. The new chapters describe vagotomy, the Blalock operation for subclavian pulmonary shunt and the repair of patent ductus arteriosis. There is also a new chapter on surgery of the peripheral vascular system by W. J. Pickett and one on facial injuries by Wayne B. Slaughter. The work is well produced and the style makes for easy reading. The seventeen pages given to knot-tying is possibly a bit out of proportion but the whole effect of the book is one of sound teaching attractively presented.

Continued on Page 34


# IMPORTANT!

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## *Books Received*

Continued from Page 552

Books are acknowledged as received, but in some cases reviews will also be made in later issues.

**Office Management for Health Workers.** F. King and L. L. Feldman. 164 pp., illust. $2.25. The Commonwealth Fund, New York, 1949.

**Pathology of the Nervous System.** J. H. Biggart, Professor of Pathology, Queen's University, Belfast. 352 pp., illust., 2nd ed. $5.25. E. & S. Livingstone Ltd., Edinburgh; Macmillan Co. of Canada Ltd., Toronto, 1949.

**Public Health Statistics.** M. F. Hall, Associate Professor of Public Health Statistics, School of Public Health, University of Michigan. 441 pp., illust., 2nd ed. $7.50. Paul B. Hoeber, Inc., New York, 1949.

**Thomas Jones Ridlon.** H. W. Orr, Chief Surgeon, Nebraska Orthopædic Hospital, Lincoln, Nebraska. Supplement by A. Steindler, Professor of Orthopædic Surgery, State University of Iowa Medical School, Iowa City. 253 pp., illust. $5.75. Charles C. Thomas, Springfield, Ill.; The Ryerson Press, Toronto, 1949.

**Hæmatology for Students and Practitioners.** W. M. Fowler, Professor of Internal Medicine, University of Iowa, Iowa City. 535 pp., illust., revised 2nd ed. $8.50. Paul B. Hoeber, Inc., New York, 1949.

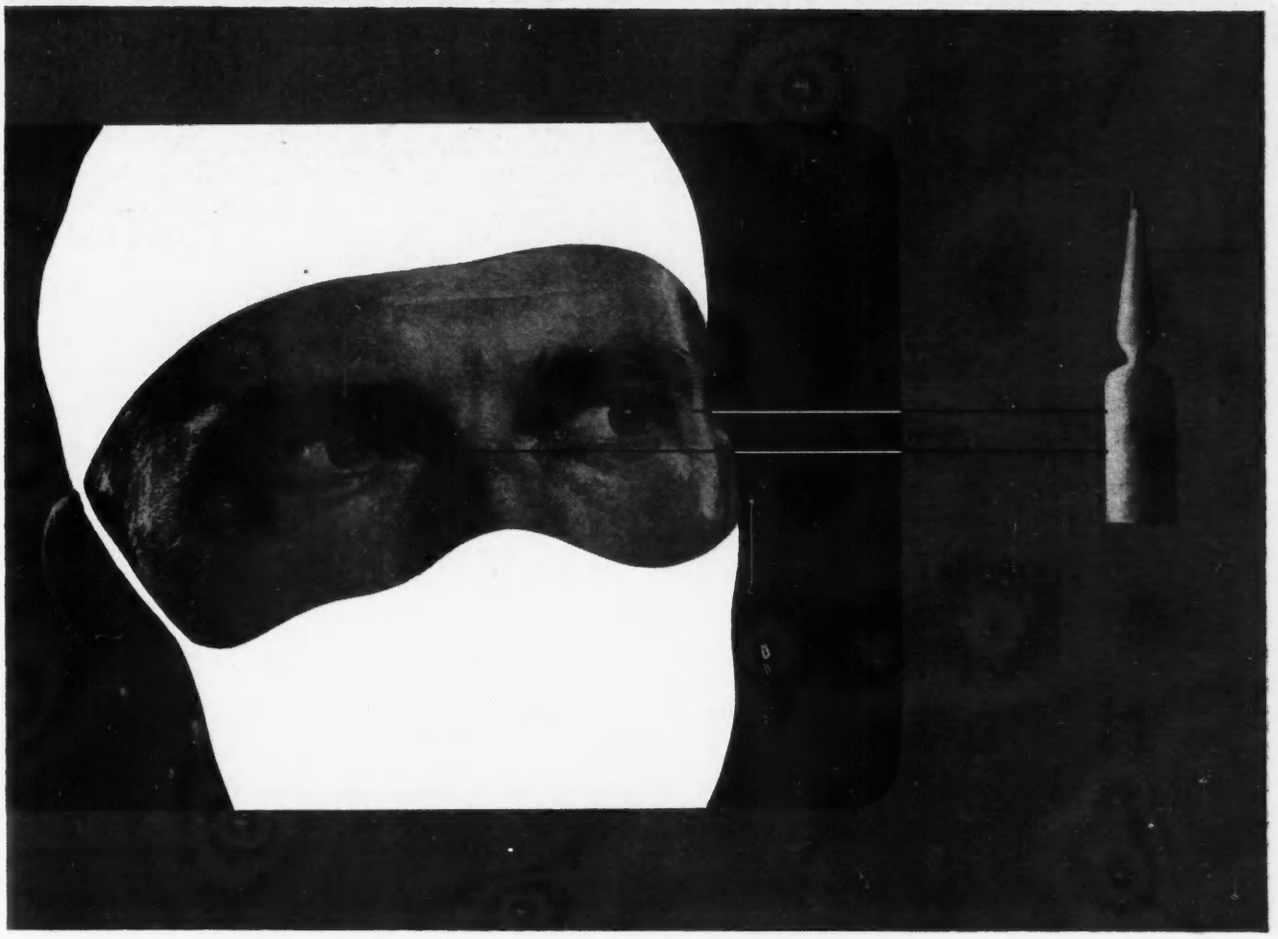
**Roentgen Diagnosis of the Extremities and Spine.** (Annals of Roentgenology, Vol. 17). A. B. Ferguson, Associate Professor, Orthopædic and Fracture Surgery, Boston University. 519 pp., illust., 2nd ed. $15.00. Paul B. Hoeber, Inc., New York, 1949.

**Syphilis: Its Course and Management.** E. W. Thomas, Professor of Clinical Medicine, New York University College of Medicine. 317 pp., illust. $5.50. Macmillan Co., New York and Toronto, 1949.

**An Account of the Schools of Surgery, Royal College of Surgeons, Dublin 1789-1948.** J. D. H. Widdess, Librarian and Lecturer in Biology, R.C.S.I. 107 pp., illust. $4.40. E. & S. Livingstone, Ltd., Edinburgh; Macmillan Co. of Canada, Toronto, 1949.

**Food Inspection Notes.** H. Hill "Ollett' Gold Medallist; and E. Dodsworth, Chief Sanitary Inspector, Borough of Harrogate. 125 pp., 3rd ed. 7s. 6d. H. K. Lewis & Co. Ltd., London, 1949.

Continued on Page 66.



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Continued from Page 34.

**Operative Technique—General Surgery.** Edited by W. H. Cole, Professor and Head of the Department of Surgery, University of Illinois College of Medicine. 951 pp., illust. $16.00. Appleton-Century-Crofts, Inc., New York, 1949.

**Clinical Methods.** Sir R. Hutchison, Consulting Physician to the London Hospital and to the Hospital for Sick Children, Great Ormond Street; and D. Hunter, Physician to the London Hospital. 484 pp., illust., 12th ed. $4.50. Cassell & Co., Ltd., London, Toronto, Melbourne, Sydney, Wellington; McClelland & Stewart Ltd., Toronto, 1949.

**Clinical Allergy.** L. Tuft, Assistant Professor of Medicine, Temple University School of Medicine and Chief of Clinic of Allergy and Applied Immunology, Temple University Hospital, Philadelphia. 690 pp., illust., 2nd ed. $13.50. Lea & Febiger, Philadelphia; Macmillan Co. of Canada Ltd., Toronto, 1949.

**A Companion in Surgical Studies.** I. Aird, Professor of Surgery in the University of London. 1060 pp. $15.75. E. & S. Livingstone Ltd., Edinburgh; Macmillan Co. of Canada Ltd. Toronto, 1949.

**Binocular Imbalance.** E. Krimsky, Adjunct Professor of Ophthalmology, New York Polyclinic Medical School. 464 pp., illust. $14.10. Lea & Febiger, Philadelphia; Macmillan Co. of Canada Ltd., Toronto, 1948.

**Diseases of the Liver, Gall Bladder and Bile Ducts.** S. S. Lichtman, Assistant Professor of Clinical Medicine, Cornell University Medical College. 1135 pp., illust., 2nd ed. $20.25. Lea & Febiger, Philadelphia; Macmillan Co. of Canada Ltd., Toronto, 1949.

**L'Ultra-violet, la lumière solaire et artificielle, l'infra-rouge.** J. Aimard et H. Dausset. 7e édition par H. Aimes et F. Betoulières. 231 pp. L'Expansion Scientifique Française, Paris, France, 1949.

**A History of Oto-laryngology.** R. S. Stevenson and D. Guthrie. 155 pp., illust. $4.40. E. & S. Livingstone Ltd., Edinburgh; Macmillan Co. of Canada Ltd., Toronto, 1949.

**Illustrations of Surgical Treatment Instruments and Appliances.** E. L. Farquharson, Assistant Surgeon, Royal Infirmary, Edinburgh. 391 pp., illust., 3rd ed. $6.25. E. & S. Livingstone Ltd., Edinburgh; Macmillan Co. of Canada Ltd., Toronto, 1949.

**Kinesiology of Corrective Exercise.** G. Hawley, formerly Head of Corrective Gymnastics at Stanford and Northwestern Universities. 192 pp., illust., 2nd ed. $4.20. Lea & Febiger, Philadelphia; Macmillan Co. of Canada Ltd., Toronto, 1949.

**Modern Treatment Yearbook 1949.** Edited by Sir Cecil Wakeley, Fellow of King's College, London. 338 pp., illust. $3.75. The Medical Press, London, W.C.2; Macmillan Co. of Canada Ltd., Toronto.

**Public Health in the World Today.** Edited by J. S. Simmons, Brigadier General, U.S. Army, Retired; Dean, Harvard School of Public Health. 332 pp., illust. $6.25. Harvard University Press, Cambridge, Massachusetts; S. J. Reginald Saunders & Co. Ltd., Toronto, 1949.

**The Epitome of Andreas Vesalius.** Translated from the Latin with Preface and Introduction by L. R. Lind, University of Kansas. 165 pp., illust. $7.50. Macmillan Co., New York and Toronto, 1949.

**Essentials of Histology.** Sir E. Sharpey-Schafer. Edited by H. M. Carleton, University Lecturer on Histology; and E. H. Leach, University Demonstrator in Physiology, Lecturer in Physiology at Lincoln College, Oxford. 655 pp., illust., 15th ed. $7.50. Lea & Febiger, Philadelphia; Macmillan Co. of Canada Ltd., Toronto, 1949.

**Manual of Medical Emergencies.** S. C. Cullen, Professor of Surgery; Chairman, Division of Anæsthesiology, State University of Iowa College of Medicine; and E. G. Gross, Professor and Head of Department of Pharmacology, State University of Iowa College of Medicine. 267 pp., illust. $3.75. The Year Book Publishers, Inc., Chicago, Ill.

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Continued from Page 66

**Neurology.** R. R. Grinker, Director of the Institute for Psychosomatic and Psychiatric Research and Training and Chairman, the Department of Neuropsychiatry of the Michael Reese Hospital, Chicago, Illinois; and P. C. Bucy, Professor of Neurology and Neurological Surgery, University of Illinois College of Medicine, Chicago, Illinois. 1138 pp., illust., 4th ed. $15.75. Charles C. Thomas, Springfield, Ill.; Ryerson Press, Toronto, 1949.

**Arthritis and Allied Conditions.** B. I. Comroe. Edited by J. L. Hollander, Assistant Professor of Physical Medicine, Graduate School of Medicine, University of Pennsylvania. 1108 pp., illust., 4th ed. $18.00. Lea & Febiger, Philadelphia; Macmillan Co. of Canada Ltd., Toronto, 1949.

**Temperature and Human Life.** C. E. A. Winslow and L. P. Herrington, John B. Pierce Laboratory of Hygiene, New Haven, Connecticut. 272 pp., illust. $4.50. Princeton University Press, Princeton, New Jersey; S. J. Reginald Saunders & Co. Ltd., Toronto, 1949.

**Explorer of the Human Brain.** The Life of Santiaga Ramon y Cajal (1852-1934). D. F. Cannon, Medical Editor for the J. B. Lippincott Co. 303 pp., illust. $4.00. Henry Schuman, New York, 1949.

**Theory and Practice of Massage and Medical Gymnastics.** B. M. Goodall-Copestake, Honorary Fellow of the Chartered Society of Physiotherapy. 424 pp., illust., 7th ed. 21s. H. K. Lewis & Co. Ltd., London, 1949.

**Transactions of the American Association of Genito-Urinary Surgeons.** Vol. XL, 1948. 215 pp., illust. Published for the Association by the Williams & Wilkins Co., Baltimore, 1949.

**Manuel Pratique de Rhumatologie.** Professor Gunnar Kahlmeter (Stockholm). Traduit du Suédois par F. Soderlindh, revu par J. Forestier. 136 pp., illust. 800 francs. L'Expansion Scientifique Française, Paris, 1949.

**Algies Vertebrales d'Origine Statique.** S. de Sèze, J. Robin, L. Auquier, A. Djian, R. Davaine, J. Durieu, S. Jurmand, R. Jaffrès. 60 pp., illust. 200 fr. L'Expansion Scientifique Française, Paris, 1949.

**Pedigrees of Negro Families.** R. R. Gates, Emeritus Professor of Botany in the University of London. 267 pp., illust. $5.50. The Blakiston Co., Philadelphia and Toronto, 1949.

**Industrial Toxicology.** A. Hamilton, Assistant Professor Emeritus of Industrial Medicine, Harvard School of Public Health, Boston, Mass.; and H. L. Hardy, Physician to the Division of Occupational Hygiene, Massachusetts Department of Labour and Industries. 574 pp., 2nd ed. $7.50. Paul B. Hoeber, Inc., New York, 1949.

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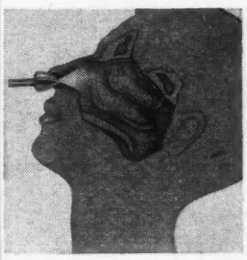

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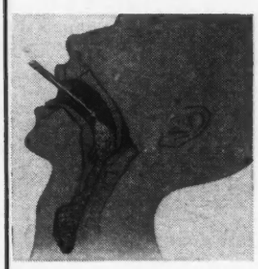

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